USER'S MANUAL 990-057
Revision K, May 2004

UNITEK PECO™
WORLD LEADER IN RESISTANCE WELDING

Use with Firmware Release V1.19 or higher

MODEL HF2
2 kHz HIGH FREQUENCY
RESISTANCE WELDING POWER SUPPLY

MODEL NUMBER	STOCK NUMBER
HF2/230	1-264-03
HF2/380	1-264-03-01
HF2/460	1-264-03-02
HF2/208	1-264-03-03
HF2S/230	1-265-03
HF2S/380	1-265-03-01
HF2S/460	1-265-03-02
HF2S/208	1-265-03-03

Units with the built-in Weld Sentry Option also require User's Manual No. 990-291

WARNING

Please be sure to read all personnel and equipment safety precautions noted in this manual.

©1998, 2002 Unitek Miyachi Corporation

The engineering designs, drawings and data contained herein are the proprietary work of UNITEK MIYACHI CORPORATION and may not be reproduced, copied, exhibited or otherwise used without the written authorization of UNITEK MIYACHI CORPORATION.

Printed in the United States of America.

REVISION RECORD

Revision	EO	Date	Basis of Revision
A	ENRG-RLSE	3/95	Released original manual.
B	None	9/95	Reorganize manual into chapters.
C	None	1/96	Amend to Firmware V1.17 or higher.
D	None	2/96	Update cover stock numbers
E	None	4/97	Amend to Firmware V1.19 or higher.
F	17472	6/98	1. Remove existing calibration procedure and reference User Calibration Procedure 994-001. 2. Miscellaneous corrections. 3. Remove SAVE error.
G	18951	8/01	1. Include EO# 17693 in manual. 2. Add latest version of Operator Guide.
H	19012	9/01	1. Include EO# 118951 in manual. 2. Add latest version of Operator Guide.
J	19146	1/02	1. Include EO# 19012. 2. Miscellaneous Corrections. 3. Add Appendix F, Quality Resistance Welding Solutions, and Appendix G, Replacement of Programmed Integrated Circuits.
K	20016	5/04	Updated wire data.

FOREWORD

The purpose of this manual is to supply operating, maintenance and service personnel with the information needed to properly and safely operate, maintain and service the Unitek Peco Model HF2 2 kHz High Frequency Resistance Welding Power Supply.

Should questions arise, or if you have suggestions for improving this manual, please contact:

Unitek Miyachi Corporation
1820 South Myrtle Avenue
P.O. Box 5033
Monrovia, CA 91017-7133
Telephone:(626) 303-5676
FAX:(626) 358-8048
E-mail: info@unitekmiyachi.com

NOTICE

Unitek Miyachi Corporation may be released from all warranty obligations if repairs or modifications are made by persons other than its own service personnel, or authorized representatives' personnel, unless such repairs or modifications are specifically authorized in writing by the Unitek Miyachi Corporation.

WARNING

Contact with voltages present in this power supply may cause serious or fatal injuries. Please read the manual completely and note all cautions and warnings before attempting to install, operate or maintain the power supply.

CONTENTS

Page

CHAPTER 1: DESCRIPTION 1-1

HF2 description 1-1

CHAPTER 2: GENERAL SET-UP 2-1

Required Connections 2-1
- Physical Space Requirements 2-1
- HF2 Weld Control Dimensions 2-1
- HF2 Weld Transformer Dimensions 2-1
- Power Line Voltage, Current, And Wire Size Requirements 2-2
- Insulation Requirements 2-2
- Power Line Fuse Requirements 2-2
- HF2 Weld Transformer Electrical Specifications 2-3
- HF2 Welding System Maximum Secondary Loop Resistance 2-4
- HF2 Maximum Secondary Loop Resistance Measurement 2-4
- HF2 Weld Control To HF2 Weld Transformer Connections 2-4
- HF2 Weld Transformer To Weld Head Connections 2-5
- Weld Sentry Option 2-5
- Help Screen Languages 2-5

CHAPTER 3: WELDING SYSTEM SET-UP 3-1

Welding System Set-Up Guide 3-1
General Programming Instructions 3-1
Unitek Peco Force Fired, Foot Actuated Weld Head System 3-2
- Weld Head Set-Up 3-2
- Firing Switch Cable Connection 3-2
- Quick Start Programming Guide 3-2

Unitek Peco Force Fired, Single Air Actuated Weld Head System 3-4
- Weld Head Set-Up 3-4
- Firing Switch Cable Connection 3-4

Weld Head Valve Driver No. 1 Connection 3-4
- Foot Switch Connection 3-4
- Single Air Regulator Adjustment (Model 80 Series) 3-5
- Dual Air Regulator Adjustments (Model 180 And Model 90 Series) 3-6
- Quick Start Programming Guide 3-6

Unitek Peco Force Fired, Dual Air Actuated Weld Head System 3-8
- General Information 3-8
- HF2 Control, Jumper Modifications 3-8
- Weld Head Set-Up 3-8
- Firing Switch Cable Connection 3-9

CONTENTS (Continued)

Page

CHAPTER 3: WELDING SYSTEM SET-UP (Continued)

Weld Head Valve Driver Connections 3-10
Foot Switch Connection 3-10
Dual Air Regulator Adjustments 3-11
Quick Start Programming Guide 3-15
Non-Force Fired, Single Air or Cam Actuated Weld Head System 3-17
LC To HF2 Control Electrical Connections 3-17
PLC Timing Diagram 3-18
Quick Start Programming Guide 3-18
Non-Force Fired, Multiple Air Actuated Weld Head System 3-20

CHAPTER 4: CONTROLS 4-1

HF2 Weld Control - Front Panel 4-1
HF2 Weld Control - Rear Panel Inputs and Outputs 4-3
Power 4-3
Fuses F1 and F2 4-3
Sensing Port 4-3
Sensing Port - Connector Pin Assignments 4-4
Output 4-4
Foot Switch Connector 4-5
Single-Level Foot Switch 4-5
Two-Level Foot Switch 4-5
Firing Switch Operation 4-6
Mechanical Firing Switch Cable 4-6
Optical Firing Switch Connector 4-6
Mechanical Firing Switch - 3-Wire Connection 4-6
Opto Coupler Firing Switch - 3-Wire Connection 4-6
Control Signals Connector 4-7
Control Signals - Pin Assignments 4-8
Control Signals - Remote Weld Schedule Selection Input 4-9
Control Signals - Emergency Stop Input 4-9
Control Signals - Process Inhibit Input 4-10
Control Signals - Output Relays 4-10
Relay K1 4-10
Relay K2 4-10
Accessory Port 4-10
Air Valve 1 and Air Valve 2 Driver Connectors 4-11
Air Valve 1 Driver 4-11
Air Valve 2 Driver 4-11

CONTENTS (Continued)

Page

CHAPTER 5: PROGRAMMING MODES 5-1

Help Screens 5-1
Machine States 5-1
Weld Graph Run State 5-1
Basic Weld Monitor Run State 5-2
Alphanumeric Run State 5-2
No Weld State 5-2
Standby State 5-2
Alarm State 5-3
Fire State 5-3
Menu State 5-3
Program State 5-4
Weld Graph Program State 5-4
Alphanumeric Program State 5-5
Output Relays 5-6
Relay 1 - Dual Air Head Operation 5-7

CHAPTER 6: ADVANCED WELDING FUNCTIONS 6-1

Weld Functions 6-1
Basic Weld 6-2
Weld / Repeat 6-3
Quench/Temper 6-4
Pre/Postheat 6-5
Up/Down Slope 6-7
Braze 6-8
Rollspot 6-9
Seam 6-10
Dual Pulse 6-11
Pulsation 6-13

CHAPTER 7: SPECIAL FEATURES 7-1

System Options 7-1
Weld Counter 7-8
Copy a Schedule 7-9
System Security 7-9
System Help 7-11
Weld Sentry 7-11
Calibrate HF2 7-11
Reset to Defaults 7-11
Installation 7-13
Transformer Model 7-13

CONTENTS (Continued)

Page

CHAPTER 8: WELD MONITORING 8-1

Basic Weld Monitor General Description 8-1
Weld Current and Weld Voltage Measurements 8-2
Data Output Capabilities 8-2
Weld Monitoring Suggestions 8-2
Basic Weld Monitor Programming 8-3
Energy Limit Monitor General Description 8-4
Energy Limit Monitor Programming 8-5

CHAPTER 9: RS-485 DATACOM 9-1

Description 9-1
RS485 Serial Port Connections 9-2
Datacom Software Installation 9-2
F1:Setup 9-4
F2:Collect Data 9-5
F3:Erase Data 9-5
F4:Exit` 9-5

APPENDIX A: TECHNICAL SPECIFICATIONS A-1

APPENDIX B: RECOMMENDED SPARE PARTS B-1

APPENDIX C: ALARM MESSAGES C-1

APPENDIX D: HELP SCREEN LANGUAGES D-1

APPENDIX E: THE BASICS OF RESISTANCE WELDING E-1

APPENDIX F: QUALITY RESISTANCE WELDING SOLUTIONS: DEFINING THE OPTIMUM PROCESS F-1

APPENDIX G: REPLACEMENT OF PROGRAMMED INTEGRATED CIRCUITS G-1

INDEX Index-1

UNITEK MIYACHI CORPORATION

Declaration of Conformity

Directive(s):	EMC, LOW VOLTAGE, MACHINERY
Type of Equipment:	Resistance Welding Power Supply Equipment
Applied Standards:	EN 60974-1/IEC60974-1/EN50199/IEC 61-1/IEC 801-2/IEC 801-4 EN 60664-1/IEC664-1
Model No.:	[illegible]

Authorized Representative Within European Community:

[illegible]
Eggbourne 217
Postbus 364
1380 AJ Helmond HOLLAND

Manufacturer's Name and Address:

UNITEK MIYACHI CORPORATION
1820 South Myrtle Avenue
Monrovia, CA 91017 U.S.A.

Based on the Declaration of Conformity Certificates issued by the test laboratories, I declare that the equipment specified above conforms to the listed directive and standards.

Place: Monrovia, CA

Date: December 16, 1996

Signature

Signature

Robert J. Wallish
Full Name

Mark D. Rodighiero
Full Name

Director of Quality Assurance
Title

Vice President, Engineering
Title

CHAPTER 1
DESCRIPTION

The Unitek Peco High Frequency Inverter (HF2) is a 2 KHz, three-phase, state-of-the-art inverter welding control for joining precision small parts at high speed with controllable rise times using 2 KHz output pulses superimposed on pure DC welding energy. High speed (250 micro-second) digital feedback automatically controls weld current, voltage, or power, providing more welding consistency compared to traditional direct energy (AC) or stored energy (CD) technologies. Microprocessor technology automatically compensates for changes in workpiece resistance, load inductance, weld transformer saturation, and ñ 13% changes in line voltage. The HF2 uses IGBT power device technology for precisely controlling the weld energy at both high and low energy levels.

Easy to use constant weld current, voltage or power feedback ensures repeatable welding and has proven to extend electrode life in many applications by a factor of five or more. A selectable weld energy limiting feature also contributes to repeatable welds and high nugget quality. The user can program the HF2 using a graphical or numerical interface. The Weld Graph Program Mode (Figure 1-1) emulates many of the popular word processing programs by using the front panel cursor keys to easily modify any time period, current, voltage, or power value. The Weld Graph Run Mode (Figure 1-2) gives the user instant visual feedback on the actual current, voltage or power used to make each weld.

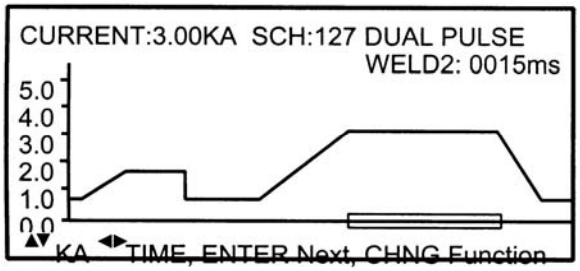


Figure 1-1. Program Mode

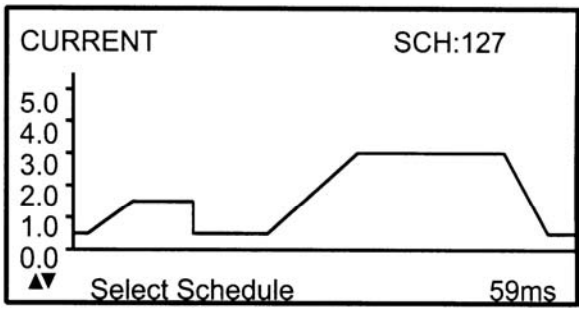


Figure 1-2. Actual Weld Current

The HF2's exclusive, context sensitive, User Help Screens quickly guide the user through even the most complex program. Each weld schedule can use any one of 10 different Weld Functions, thus matching the appropriate weld energy profile to the application.

Simple automated welding control is easily accomplished using the BCD Remote Schedule Select feature. For more complex automation processes, a host computer can use the HF2 Bi-Directional RS422/RS485 Communications Port to select HF2 Weld Schedules and receive average weld current and weld voltage data for each weld. Refer to the separate RS-485 Datacom Manual, P/N: 990-058, for Advanced RS-485 Datacom operation. The 2 KHz operating frequency ensures that the HF2 Weld Transformers are light weight and compact, providing a significant advantage when they are built into robotics or automatic machines.

CHAPTER 2
GENERAL SET-UP

REQUIRED CONNECTIONS

Physical Space Requirements

Unitek Peco recommends that the HF2 Weld Control and HF2 Weld Transformer be installed in a well ventilated area that is free from excessive dust, acids, corrosive gases, salt and moisture. Allow sufficient clearance around both sides and back of the HF2 Weld Control and HF2 Weld Transformer so that cooling air may flow properly. Figure 2-1 shows the cooling airflow pattern for the HF2 Weld Control. Figure 2-2 shows the cooling airflow pattern for the HF2 Weld Transformer.

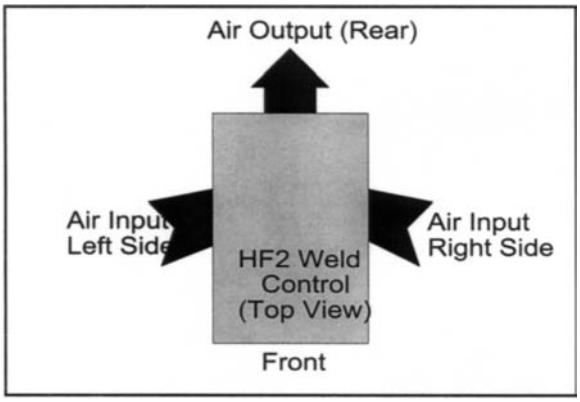


Figure 2-1. HF2 Weld Control Air Flow Pattern

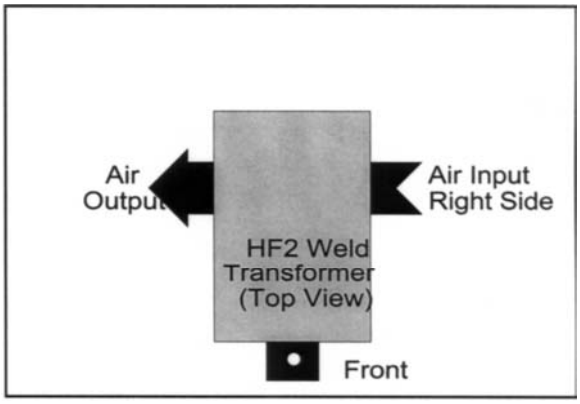


Figure 2-2. HF2 Weld Transformer Air Flow Pattern

HF2 Weld Control Dimensions

Width (in/cm)	Height (in/cm)	Depth (in/cm)	Weight (lbs/Kg)
10.5 / 26.7	8.5 / 21.5	15.0 / 38.1	42 / 19

HF2 Weld Transformer Dimensions

Model	Height (in/cm)	Width (in/cm)	Depth (in/cm)	Weight (lbs/Kg)
X2/2000A	7.0 / 17.6	5.4 / 13.8	11.0 / 28.0	14.3 / 6.5
X3/4000A	7.2 / 18.3	7.2 / 18.3	13.4 / 34.0	28.6 / 13
X5/3000A	7.5 / 18.9	7.2 / 18.3	14.2 / 36.0	31 / 14
X11/4000A	7.5 / 18.9	7.2 / 18.3	17.9 / 45.5	46 / 21
X11/4/460A	7.4 / 18.8	7.2 / 18.3	18.9 / 48.5	55 / 25
X3/4/380A	7.2 / 18.3	7.2 / 18.3	13.4 / 34.0	28.6 / 13
X3/4/460A	7.2 / 18.3	7.2 / 18.3	13.4 / 34.0	28.6 / 13

Power Line Voltage, Current, and Wire Size Requirements

WARNING: The HF2 Weld Control and HF2 Weld Transformer are assembled at the factory for operation at a specific input power line voltage. Serious damage can result if these units are used on different voltage other than the voltage for which they are wired. The HF2 weld transformer input voltage must match the HF2 weld control power line voltage.

Use the following table to select the correct power line circuit breaker and wire gauge size. To minimize peak power losses, use single unbroken wire lines. Note: To minimize peak power losses, Unitek Peco recommended wire gauge sizes exceed the USA National Electrical Code recommendations.

3-Phase Service Voltage (RMS)	3-Phase Service Breaker Current (RMS)	Copper Wire Gauge Size (AWG)
208V to 230V	50A	AWG 8 @ 133 strands
380V to 460V	30A	AWG 10 @ 105 strands

Insulation Requirement

Oil-resistant synthetic rubber rated at 90°C and 600V.

Power Line Fuse Requirements

Service Voltage	Fuse Size: F1, F2	Unitek Peco P/N
208, 230, 380	3AG, 440 V, 2 A	330-071
460	3AG, 500 V, 2 A	330-100

HF2 Weld Transformer Electrical Specifications

Model	Input Volts (Rms)	Input kva (Rms)	Duty Cycle (%)	Peak Open Ckt Output Voltage	Peak Output Max. (Amps)	Max Sec Resist. (μΩ)
X3/4/380A	380	9	6	6.5	4,000	500
X3/4/460A	460	9	6	6.5	4,000	500
X3/4000A	230	9	6	6.5	4,000	500
X9/6000A	230	19	6	9.3 (32:1 TR)	4,900	500
X11/4/460A	380	4	5	11.8 (44:1 TR) 10.0 (52:1 TR) 8.6 (60:1 TR) 7.5 (68:1 TR)	4,000 4,000 4,000 4,000	1,300 1,100 950 825
	460	4	5	14.3 (44:1 TR) 12.1 (52:1 TR) 10.5 (60:1 TR) 9.2 (68:1 TR)	4,000 4,000 4,000 4,000	1,300 1,100 950 825
X11/4000A	230	15	5	10.7 10.0 (52:1 TR) 8.6 (60:1 TR) 8.7 8.8 8.9	4,000 4,000 4,000	1,300 1,100

TRANSFORMER SPECIFICATION NOTES:

1 For the Model X11/4/460A, turns ratios (TR) are selectable by a switch on the transformer rear panel.

2 HF2 Weld Control Input voltage selection must be jumpered at E12 on the HF2 Weld PCB as shown in Figure 2-3. E12 is located at the center of the PCB left edge.

3 Maximum weld time at Maximum Short Circuit Current is 50 milliseconds.

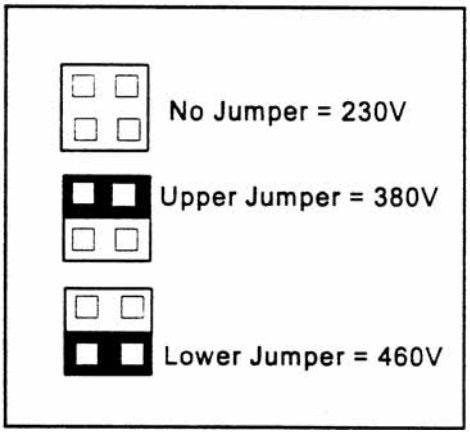


Figure 2-3. Voltage Jumpers

HF2 Welding System Maximum Secondary Loop Resistance

To use the HF2 Weld Control and HF2 Weld Transformer system to its maximum capability, the Maximum Secondary Loop Resistance must not exceed the values listed in the preceding table. Exceeding these maximums will produce a "FEEDBACK RANGE EXCEEDED" alarm.

HF2 Maximum Secondary Loop Resistance Measurement (Figure 2-4)

1 Connect a four terminal micro-ohmmeter as shown in Figure 2-4.

2 Put the parts to be welded between the electrodes.

3 Measure the total loop resistance which includes both Weld Cables, Weld Head, Electrodes, and parts.

4 If the total loop resistance exceeds the table value, use:

A) Larger diameter Weld Cables

B) Shorter length Weld Cables, or

C) Copper Bus Bars to connect the HF2 Weld Transformer to the Weld Head. If these suggestions do not work, then a different Weld Transformer Model may be required.

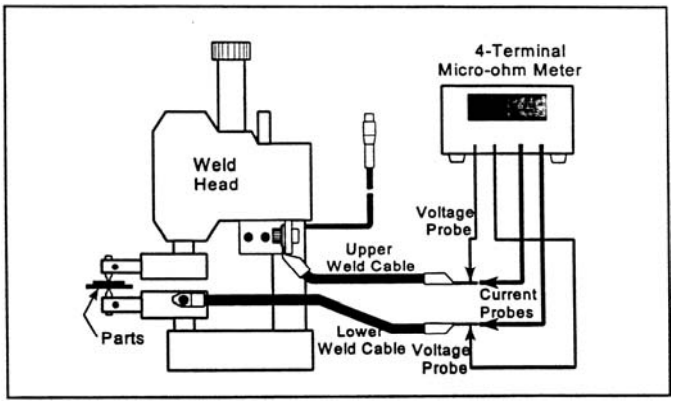


Figure 2-4. Secondary Resistance Measurement

CAUTION: For product safety, the system power cable and all inter-unit cabling should be as short as possible, and be dressed so that all cables stay separated.

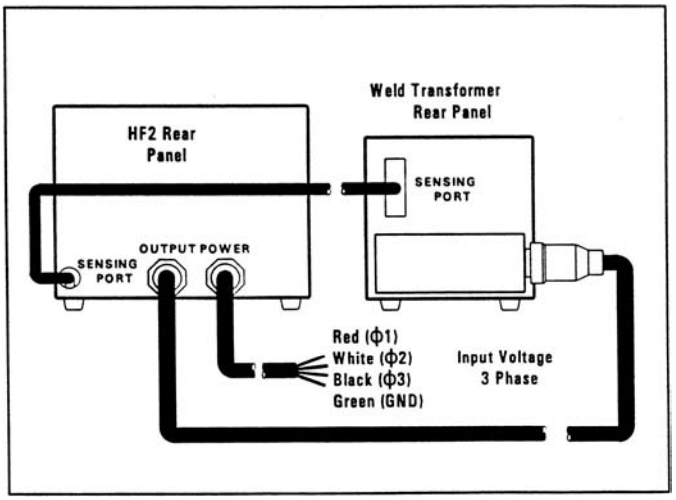
HF2 Weld Control to HF2 Weld Transformer Connections (Figure 2-5)

The HF2 Weld Control must always be connected to the HF2 Weld Transformer as shown in Figure 2-5, regardless of what Weld Head System is used.

1 Connect the HF2 Weld Control POWER Cable to the line voltage source as specified in *Chapter 2, Power Line Voltage, Current, and Wire Size Requirements.*

2 Connect the HF2 Weld Control OUTPUT Cable to the matching connector on the HF2 Weld Transformer.

3 Connect the HF2 Weld Control SENSING PORT Cable to the matching connector on the HF2 Weld Transformer.



HF2 Weld Transformer to Weld Head Connections (Figure 2-6)

1 Connect the Upper Weld Cable to the Positive Terminal on the HF2 Weld Transformer.

2 Connect the Lower Weld Cable to the Negative Terminal on the HF2 Weld Transformer.

3 Attach the Voltage Sensing Cable connector to the HF2 Weld Transformer INPUT connector.

4 Attach each lead at the opposite end of the Voltage Sensing Cable to each Electrode Holder. Note: Polarity is not important.

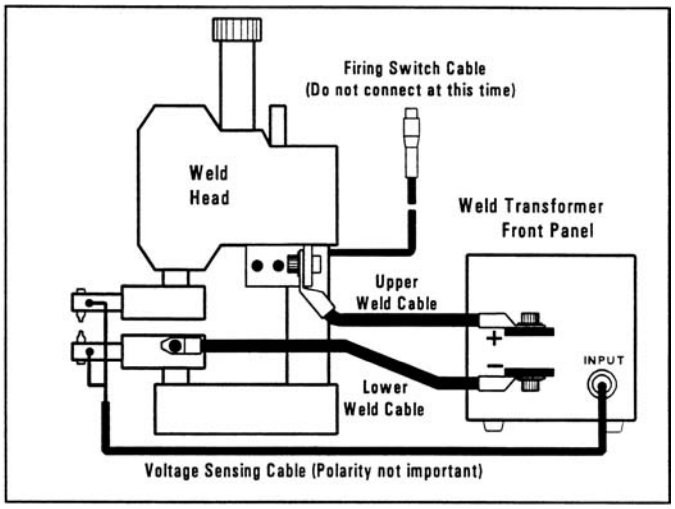


Figure 2-6. HF2 Weld Transformer to Weld Head Connections

5 Strain relief each Voltage Sensing lead to its corresponding Electrode Holder so that the lead will not break or move under heavy production operating conditions.

6 Do ***not*** attach the Firing Switch Cable at this time. This procedure is covered in *Chapter 3*.

Weld Sentry Option

A small tag displaying the message WELD SENTRY INSTALLED will be attached to the front panel of the HF2 Weld Control if the optional Weld Sentry Module has been installed. Refer to the separate Weld Sentry User's Manual, 990-291 for Weld Sentry operation.
The Built-in Weld Sentry Module can be added to the HF2 Weld Control after purchase by ordering the HF2 Weld Sentry Module, P/N 3-130-01-01.

Help Screen Languages

Integrated circuit chip U2 on the Main printed circuit board varies in memory capacity according to the help screen languages available. Refer to *Appendix D* for special jumpering instructions relative to the installation of IC chip U2.

CHAPTER 3
WELDING SYSTEM SET-UP

Welding System Set-Up Guide

To complete the welding system installation, select the welding system that best matches your Weld Head configuration using the Welding System Set-Up Guide listed below:

Welding System Set-Up Guide	Page
Unitek Equipment Force Fired, Foot Actuated Weld Head	3-2
Unitek Equipment Force Fired, Single Air Actuated Weld Head	3-4
Unitek Equipment Force Fired, Dual Air Actuated Weld Head	3-9
Non-Force Fired, Single Air or Cam Actuated Weld Head	3-17
Non-Force Fired, Multiple Air Actuated Weld Heads	Not Released

General Programming Instructions

The following nomenclature and symbols will be used for programming the HF2 Weld Control:

1. Press and release HF2 Weld Control front panel keys that are enclosed by [ ] symbols.
2. Use the vertical cursor keys [▲▼] in conjunction with the horizontal cursor keys [◄►] to select or highlight a requested Menu Option, followed by the [ENTER] key.
3. Words shown in *UPPER CASE ITALIC* letters indicate *flashing* Menu Options on the HF2 Weld Control LCD Display.

UNITEK EQUIPMENT FORCE FIRED, FOOT ACTUATED WELD HEAD SYSTEM

Weld Head Set-up

1 Adjust the Weld Head Force Adjust Knob to produce 5 units of force as displayed on the Force Indicator. For a complete description of force control and its effect on the welding process, please refer to your Weld Head manual.

2 Install electrodes in Weld Head Electrode Holders.

Firing Switch Cable Connection

Connect the Weld Head Firing Switch Cable Connector to the matching cable connector on the rear of the HF2 Weld Control.

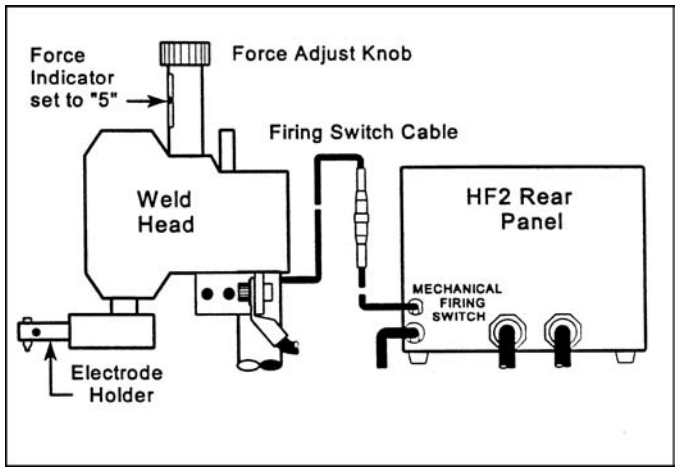


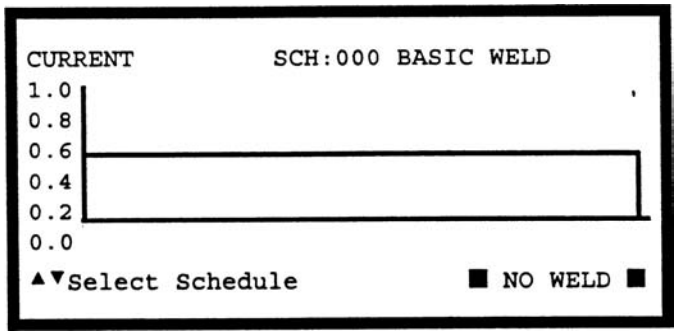
Figure 3-1. Firing Switch Cable Connection

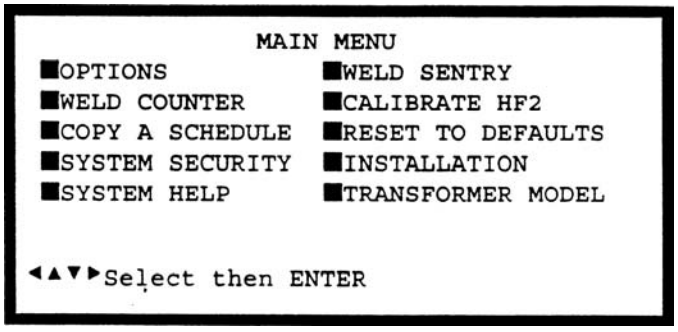
Quick Start Programming Guide

1 Set the HF2 Weld Control front panel WELD/NO WELD switch to NO WELD.

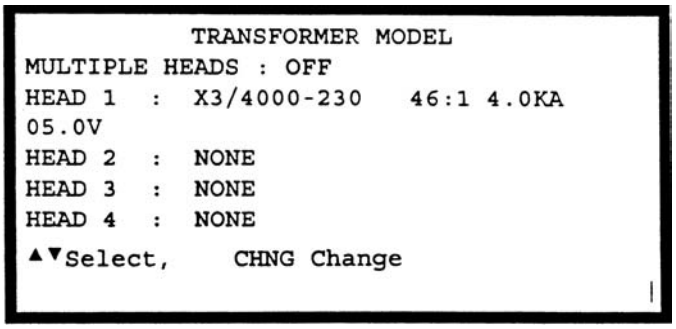
2 Turn the circuit breaker switch located on the HF2 Weld Control rear panel to ON. After a series of power up screens, the last RUN screen displayed will appear. Press the [CHNG] key to access the Weld Graph RUN screen for the BASIC WELD Function.

3 Press [MENU]. The MAIN MENU screen will appear.





4 Select □ TRANSFORMER MODEL. The TRANSFORMER MODEL screen appears.



5 Select MULTIPLE HEADS: OFF. If the display reads ON, then press [CHNG] until OFF is displayed.

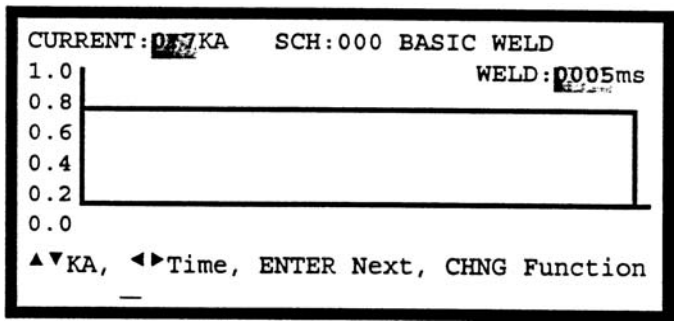
6 Select HEAD 1 : X3/4000-230. X3/4000-230 is the default Transformer Model number. Press [CHNG] until the correct Transformer Model that you have purchased appears.

7 Press [RUN] to return to the Graphical RUN screen.

8 Set the HF2 Weld Control front panel WELD/NO WELD switch to WELD.

9 Make a test weld by pressing on the Weld Head foot actuator until the HF2 Weld Control fires. The default WELD time of 1 ms and the default CURRENT of 0.5 kA may not be sufficient to make a good weld.

10 Press [PROG]. Use the vertical cursor keys [▲▼] to increase the weld CURRENT. Use the horizontal cursor keys [◀▶] to increase or decrease the WELD time. In this example, weld CURRENT has been increased to 0.7 kA and WELD time has been increased to 5ms.



11 Press [SAVE] to save your program. You are now back in the Weld Graph RUN State.

12 Make additional test welds and then reprogram WELD time and weld CURRENT as necessary to make a good weld. Try to use the minimum time and current necessary to make a good weld so that the weld joint heat affected zone will be minimized.

13 Up to 128 different weld schedules can be created and saved. To recall any specific weld schedule, press the up or down vertical arrow keys [▲▼] until the desired schedule number appears on the display screen. A faster technique for recalling a specific schedule is to input the Schedule number using the number keys.

UNITEK EQUIPMENT FORCE FIRED, SINGLE AIR ACTUATED WELD HEAD SYSTEM

Weld Head Set-up (Figure 3-2)

1 Adjust the Weld Head Force Adjust Knob to produce 5 units of force as displayed on the Force Indicator. For a complete description of force control and its effect on the welding process, please refer to your Weld Head manual.

2 Install electrodes in Weld Head Electrode Holders.

3 Connect a properly filtered air line to the Inlet Air Line on the Weld Head Air Valve Driver Solenoid assembly which is located on the back of the Weld Head. Use 0.25 inch O.D. by 0.17 inch I.D. plastic hose with a rated burst pressure of 250 psi. A lubricator should only be used with automated installations. Turn on the air system and check for leaks.

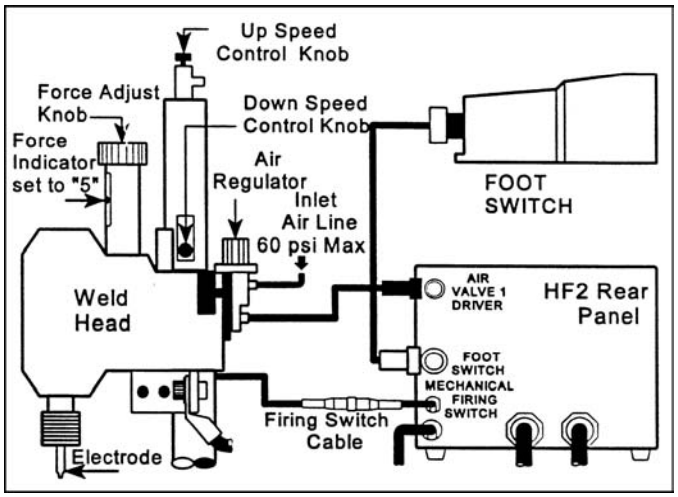


Figure 3-2. Single Air Actuated Weld Head Connections

Firing Switch Cable Connection (Figure 3-2)

Connect the Weld Head Firing Switch Cable Connector to the matching cable connector on the rear of the HF2 Weld Control.

Weld Head Valve Driver No. 1 Connection (Figure 3-2)

A single air actuated Weld Head has one Solenoid Valve Driver Cable for automatic actuation and timing control by the HF2 Weld Control. The HF2 Weld Control will automatically recognize the solenoid voltage of the Weld Head. Connect the 4 pin black plastic connector on the cable to the matching Air Valve 1 Driver connector located on the HF2 Weld Control rear panel.

Foot Switch Connection (Figure 3-2)

1 Connect a Model FS1L, 1-Level, or a Model FS2L, 2-Level Foot Switch to the FOOT SWITCH connector located on the HF2 rear panel. The HF2 will automatically recognize which model of Unitek Equipment Foot Switch has been connected.

2 **1-Level Foot Switch** - The l-Level Foot Switch must be fully depressed by the operator. When the Foot Switch closes, the HF2 energizes the Air Actuated Weld Head, causing the Upper Electrode to descend and apply force to the parts. If the Foot Switch is released before the Weld Head applies the Preset Firing Force, the HF2 will automatically return the Upper Electrode to its up position.

3 **2-Level Foot Switch** - When a 2-Level Foot Switch is pressed to the first level, the HF2 energizes the Air Actuated Weld Head, causing the Upper Electrode to descend and apply force to the parts. If the Foot Switch is released before the operator presses the Foot Switch to the second level, the HF2 will automatically return the Upper Electrode to its up position so that the parts can be repositioned. Once the second level has been reached and the Force Firing Switch in the Weld Head has closed, Weld Current will flow and the HF2 will automatically return the Upper Electrode to its up position.

Single Air Regulator Adjustment (Model 80 Series Weld Heads - Figure 3-2)

1 Set the HF2 Weld Control front panel WELD/NO WELD switch to NO WELD.

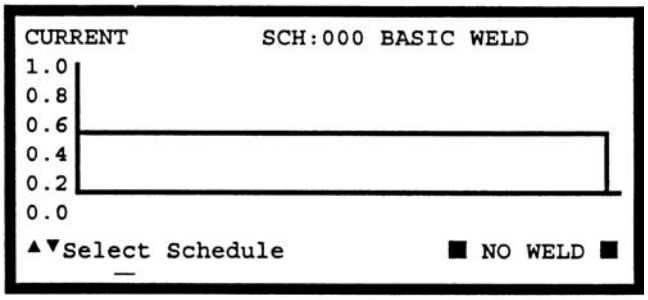
2 Turn the Power Switch located on the HF2 Weld Control rear panel to ON. After a series of power up screens, the last RUN screen displayed will appear. Press the [CHNG] key to access the Weld Graph RUN screen for the BASIC WELD function.

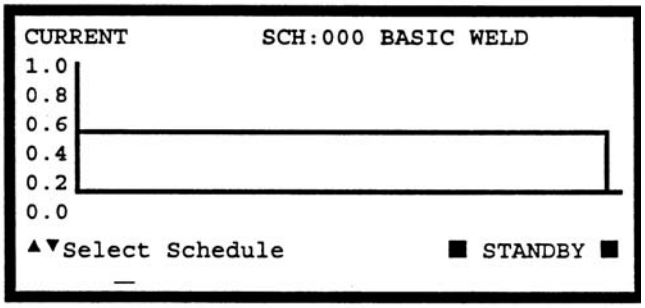
3 Turn the Air Regulator Clockwise (CW) to produce 10 psi on the Pressure Gauge.

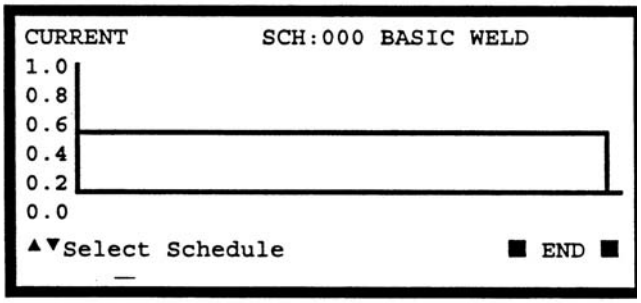
4 Press and hold the Foot Switch completely down to close all switch levels. The lower right hand corner of the display should show the status message □ STANDBY □.

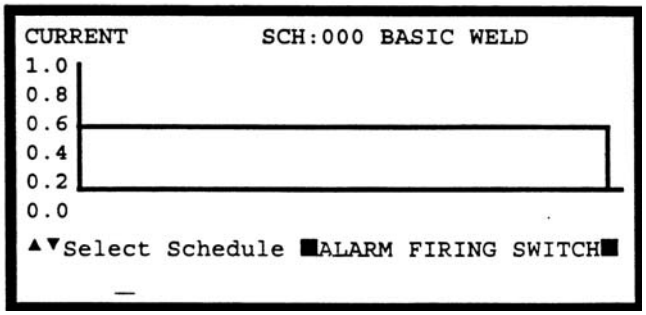
5 Continuing turning the Air Regulator Clockwise (CW) until the HF2 automatically returns the Upper Electrode to its "up position". The lower right hand corner of the display should now show the status message □ END □ if you have not released the Foot Switch. Release the Foot Switch.

6 **Note:** You have 10 seconds to make the Air Regulator adjustment or a buzzer alarm will sound and the HF2 will automatically return the Upper Electrode to its up position. The status message changes from □ STANDBY □ to □ ALARM FIRING SWITCH □. Press [RUN] to clear the alarm and then repeat steps 4 and 5.









7 Adjust the Down Speed Control Knob so the Upper Electrode descends smoothly onto the parts.

8 Adjust the Up Speed Control Knob so that the Upper Electrode Holder does not impact upon returning to in "up position".

Dual Air Regulator Adjustments (Model 180 Series and Model 90 Series Weld Heads - Figure 3-2)

1 Turn the Air Regulator located on the right-hand side of the Weld Head Clockwise (CW) to produce 10 psi on the Pressure Gauge.

2 Adjust the left-hand side Air Regulator following steps 4, 5, and 6 for the Single Air Regulator Adjustment.

3 Re-adjust the right-hand side Air Regulator to produce the same air pressure as finally used on the left-hand side Air Regulator.

4 Repeat steps 7 and 8 for the Single Air Regulator Adjustment.

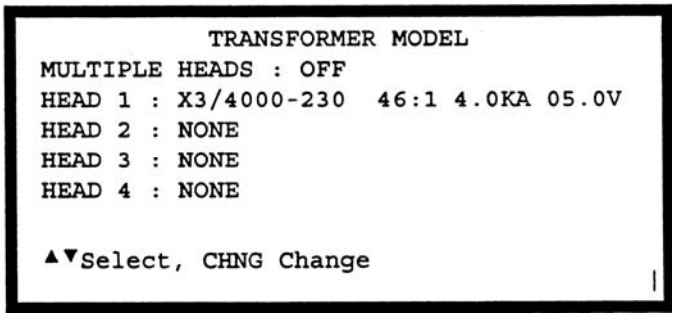
Quick Start Programming Guide

1 Press [MENU]. The MAIN MENU screen will appear.

2 Select TRANSFORMER MODEL. The TRANSFORMER MODEL screen appears.

3 Select MULTIPLE HEADS: *OFF*. If the display reads ON, then press [CHNG] until OFF is displayed.

4 Select HEAD 1 : *X3/4000-230*. X3/4000-230 is the default Transformer Model number. Press [CHNG] until the correct Transformer Model that you have purchased appears.

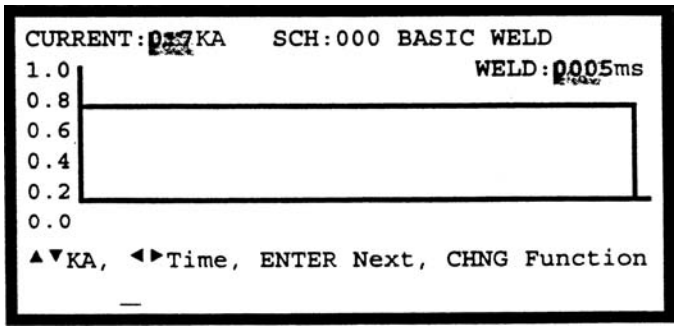


5 Press [RUN] to return to the Weld Graph RUN State.

6 Set the HF2 Weld Control front panel WELD/NO WELD switch to WELD.

7 Make a test weld by pressing on the Weld Head foot actuator until the HF2 Weld Control fires. The default WELD time of 1 ms and the default CURRENT of 0.5 KA may not be sufficient to make a good weld.

8 Press [PROG]. Press [ENTER] to change SQUEEZE to WELD, as displayed in the upper right corner. Use the vertical cursor keys [□□] to increase the weld CURRENT. Use the horizontal cursor keys [◀▶] to increase or decrease the WELD time. In this example, weld CURRENT has been increased to 0.7 KA and WELD time has been increased to 0.5 ms.



9 Press [SAVE] to save your program. You are now back in the Weld Graph RUN State.

10 Make additional test welds and then re-program WELD time and weld CURRENT as necessary to make a good weld. Strive to use minimum time and current necessary to make a good weld so that the weld joint heat affected zone will be minimized.

11 Up to 128 different weld schedules can be created and saved. To recall any specific weld schedule, press the up or down vertical arrow keys [▲▼] until the desired schedule number appears on the display screen. A faster technique for recalling a specific schedule is to input the Schedule number using the number keys.

UNITEK EQUIPMENT FORCE FIRED, DUAL AIR ACTUATED WELD HEAD SYSTEM

General Information

Dual Air Actuated Weld Head System operation uses sequential action to activate one Weld Head and then a second weld head using a single HF2 Weld Control and HF2 Weld Transformer. The operator must close and release the Foot Switch to initiate each sequential weld. Sequential Weld Head activation ensures that only one weld current path exists at a single point in time. To use multiple Weld Heads simultaneously, refer to *Chapter 3, Non-Force Fired, Multiple Air Actuated Weld Head System.*

HF2 Weld Control, Jumper Modifications (Figure 3-3)

Warning: ***Before*** modifying jumpers, disconnect the 3-phase input power to the HF2 to prevent serious injury.

1 Remove the HF2 Weld Control cover.

2 The HF2 Weld Control PCB is located on the right-hand side of the HF2 Weld Control. Locate Jumpers E10 and E11 by looking in the lower right-hand corner of the HF2 Weld Control PCB.

3 Using a needle nose pliers, move Jumpers E10 and E11 from the RELAY position to the HEAD2 position.

4 Replace the HF2 Weld Control cover.

5 Connect 3 phase input power to the HF2.

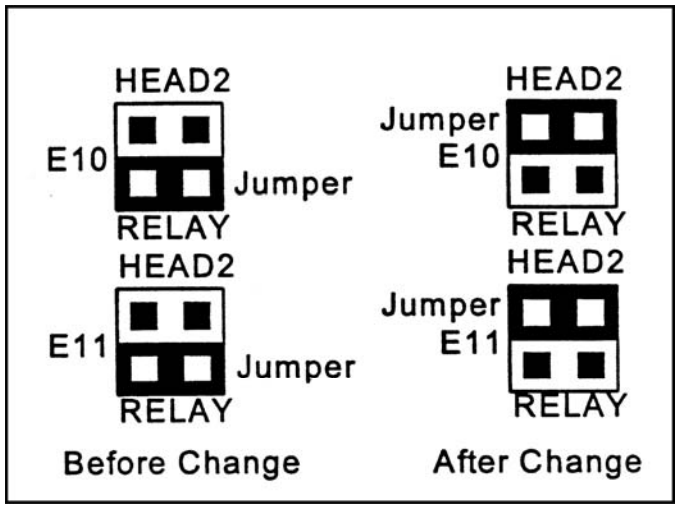


Figure 3-3. HF2 Jumper Modifications

Weld Head Set-up (Figure 3-4)

1 Connect the Upper Weld Cable from each Weld Head to the Positive Terminal on the HF2 Weld Transformer.

2 Connect the Lower Weld Cable from each Weld Head to the Negative Terminal on the HF2 Weld transformer.

3 Adjust each Weld Head Force Adjust Knob to produce 5 units of force as displayed on the Force Indicator. For a complete description of force control and its effect on the welding process, please refer to your Weld Head manual.

4 Install electrodes in each Weld Head Electrode Holder.

5 Parallel two sets of twisted wire cables to the clip end of the standard Voltage Sensing Cable that is connected to the Weld Transformer front panel. Connect one twisted wire cable to the Left Weld Head electrodes and the other twisted wire cable to the Right Weld Head electrodes.

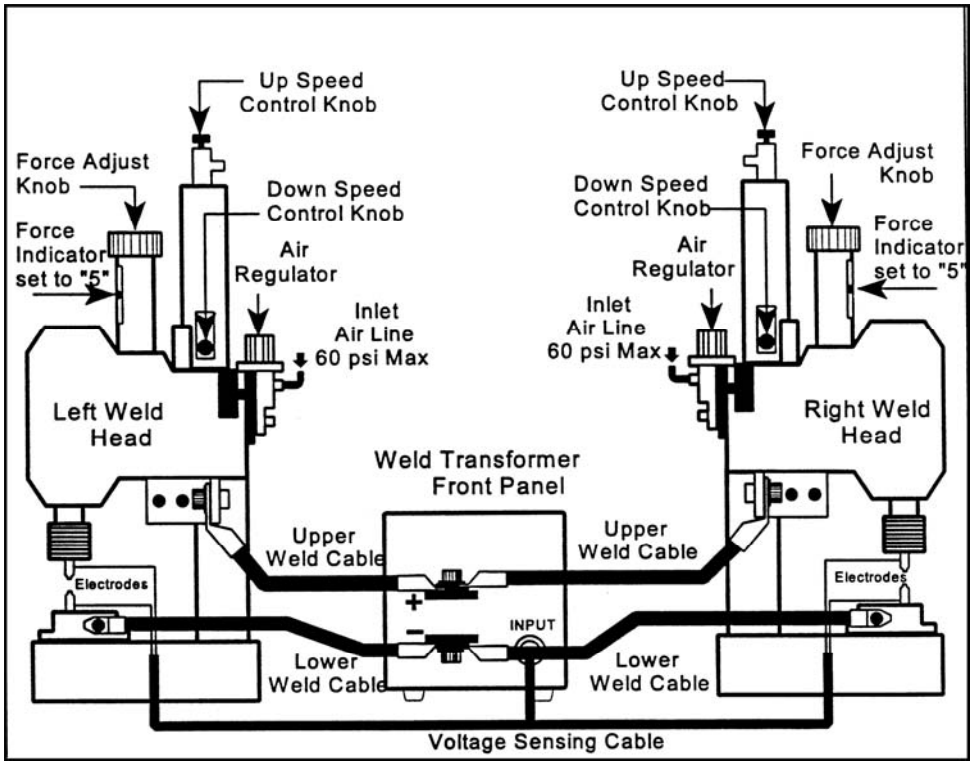


Figure 3-4. Weld Cable and Air Line Connections for Dual Air Actuated Weld Heads

6 Connect a properly filtered air line to the Inlet Air Line on the Weld Head Air Valve Driver Solenoid assembly which is located on the back of the Weld Head. Use 0.25 inch O.D. by 0.17 inch I.D. plastic hose with a rated burst pressure of 250 psi. Run separate air lines to each Inlet Air Line. Do not split a single 0.25 O.D. line into two lines or the Weld Heads will not have sufficient air flow to work properly. A lubricator should only be used with automated installations. Turn on the air system and check for leaks.

Firing Switch Cable Connection (Figure 3-5)

Connect the Weld Head Firing Switch Cable Connector on each Weld Head to the matching connectors on the Model DFS Parallel Switch Box. Connect the Model DFS Firing Switch Cable to the matching cable connector on the rear of the HF2 Weld Control.

Weld Head Valve Driver Connections (Figure 3-5)

1 Each air actuated Weld Head has one Solenoid Valve Driver Cable for automatic actuation and timing control by the HF2 Weld Control. The HF2 Weld Control will automatically recognize the solenoid voltage of your Weld Head. Connect the 4 pin black plastic connector on the Left Weld Head Solenoid Valve Driver Cable to the matching Air Valve 1 Driver connector located on the HF2 Weld Control rear panel.

2 Connect the 4 pin black plastic connector on the Right Weld Head Solenoid Valve Driver Cable to the matching Air Valve 2 Driver connector located on the HF2 Weld Control rear panel.

Foot Switch Connection (Figure 3-5)

1 Connect a Model FS1L, 1-Level, or a Model FS2L, 2-Level Foot Switch to the FOOT SWITCH connector located on the HF2 rear panel. The HF2 will automatically recognize which model of Unitek Equipment Foot Switch has been connected.

2 **1-Level Foot Switch** -- The l-Level Foot Switch must be fully depressed by the operator. When the Foot Switch closes, the HF2 energizes the Air Actuated Weld Head, causing the Upper Electrode to descend and apply force to the parts. If the Foot Switch is released before the Weld Head applies the Preset Firing Force, the HF2 will automatically return the Upper Electrode to its up position.

3 **2-Level Foot Switch** -- When a 2-Level Foot Switch is pressed to the first level, the HF2 energizes the Air Actuated Weld Head, causing the Upper Electrode to descend and apply force to the parts. If the Foot Switch is released before the operator presses the Foot Switch to the second level, the HF2 will automatically return the Upper Electrode to its up position so that the parts can be repositioned. Once the second level has been reached and the Force Firing Switch in the Weld Head has closed, Weld Current will flow and the HF2 will automatically return the Upper Electrode to its up position.

Dual Air Regulator Adjustment (Model 188 - Figure 3-5)

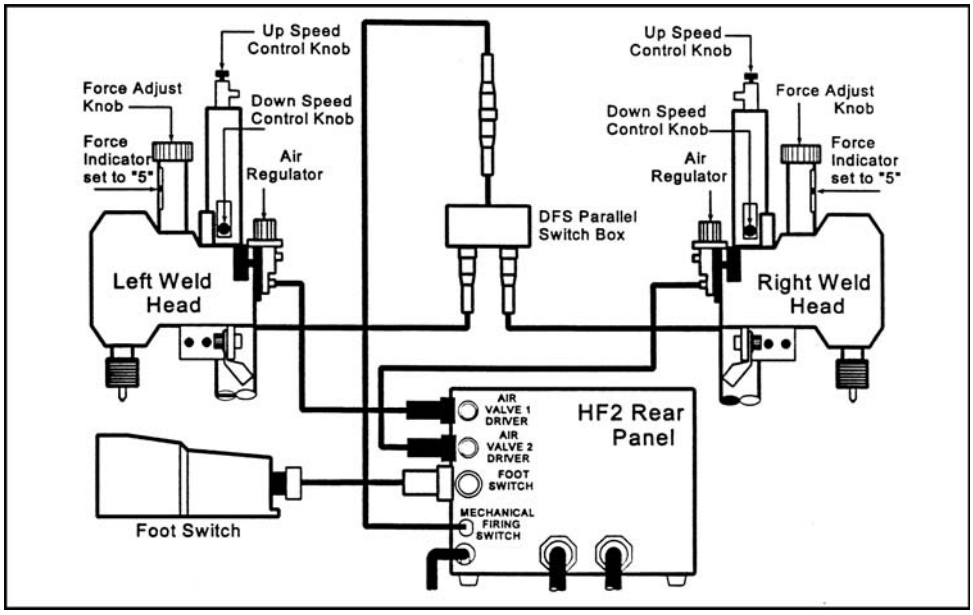
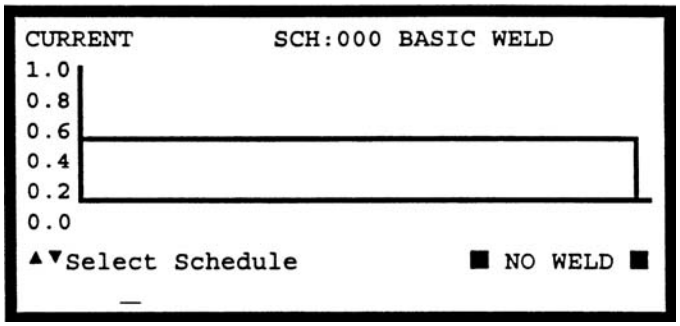


Figure 3-5. Dual Air Actuated Weld Heads Electrical Connections

1 Set the HF2 Weld Control front panel WELD/NO WELD switch to NO WELD.

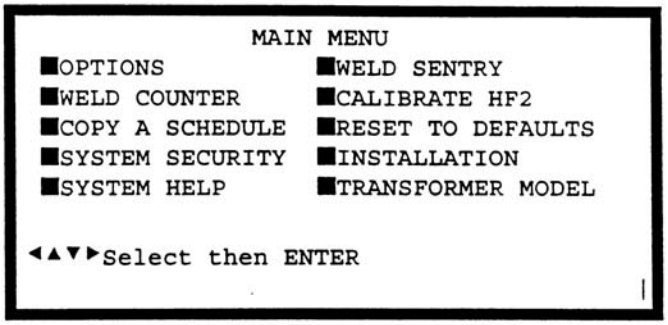
2 Turn the Power Switch located on the HF2 Weld Control rear panel to ON. After a series of power up screens, the last RUN screen displayed will appear. Press the [CHNG] key to access the Weld Graph RUN screen for the BASIC WELD Function.



3 Press [MENU]. The MAIN MENU screen will appear.

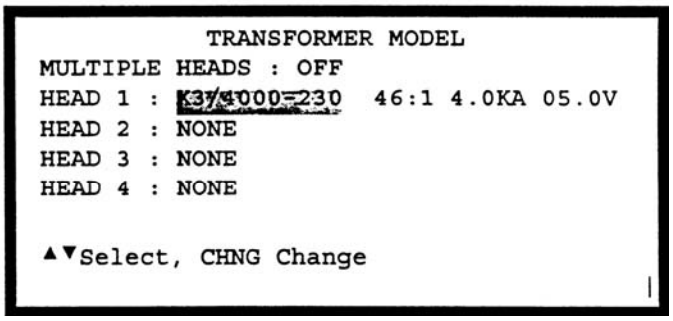
4 Select TRANSFORMER MODEL. The TRANSFORMER MODEL screen appears.

5 Select MULTIPLE HEADS: *OFF*. If the display reads ON, press [CHNG] until OFF is displayed.



6 Select HEAD 1 : *X3/4000-230*. X3/4000-230 is the default Transformer Model number. Press [CHNG] until the correct Transformer Model that you have purchased appears.

7 Press [MENU] to return to the MAIN MENU screen.

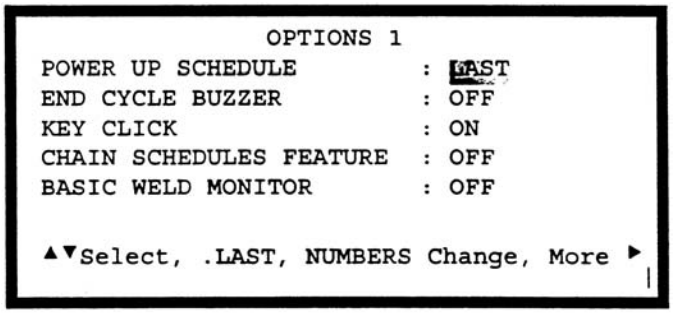


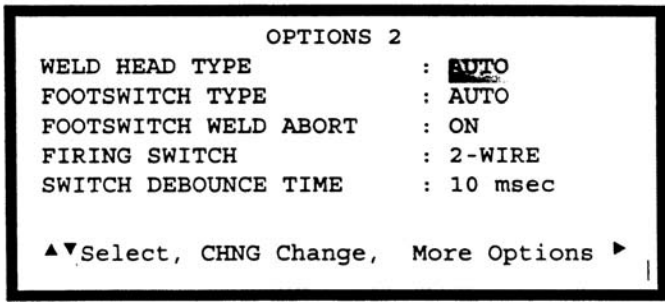
8 Select OPTIONS. The OPTIONS 1 screen appears.

9 Press [▶] to select the OPTIONS 2 screen.

10 Select WELD HEAD TYPE: AUTO. Press [CHNG] until the DUAL AIR option appears.

11 Press [MENU] to return to the MAIN MENU.

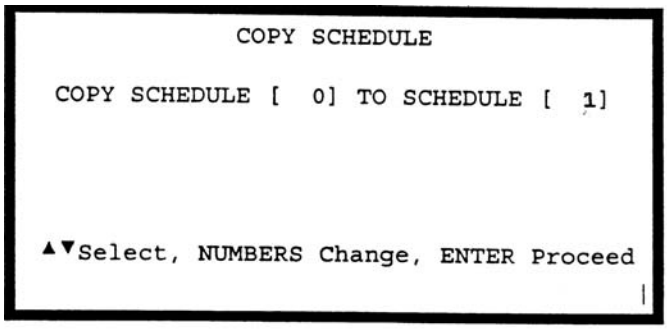




12 Select COPY A SCHEDULE. The COPY SCHEDULE screen will appear.

13 Select the last flashing 0 of TO SCHEDULE [0] and use the number keys to change the flashing 0 TO SCHEDULE [1].

14 Press [ENTER] to complete the schedule copy process and to automatically return to the Weld Graph RUN State.

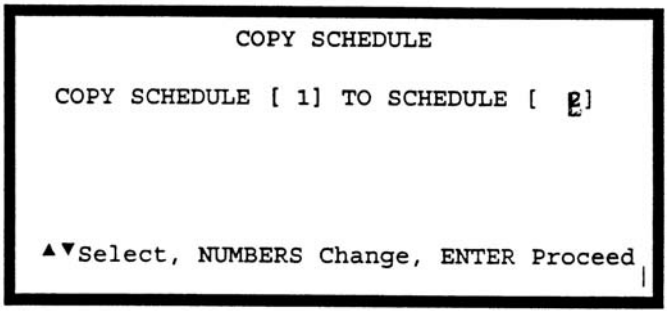


15 Press [MENU] to return to the MAIN MENU.

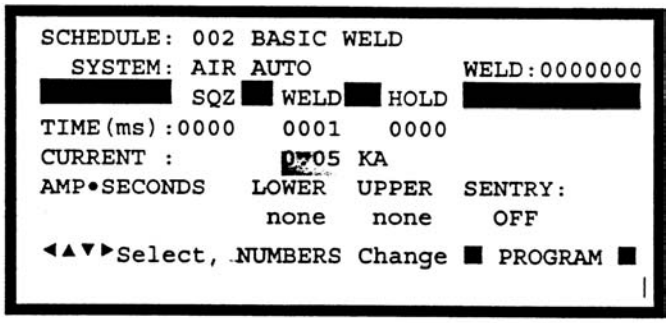
16 Select COPY A SCHEDULE. The COPY SCHEDULE screen will appear.

17 Select the last flashing 1 of TO SCHEDULE [1] and use the number keys to change the flashing 1 TO SCHEDULE [2].

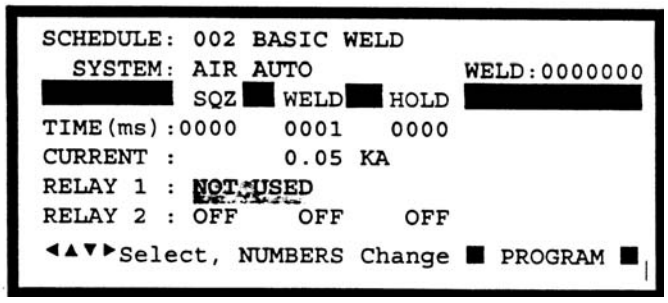
18 Press [ENTER] to complete the schedule copy process and to automatically return to the Weld Graph RUN State.



19 Press [PROGRAM] twice to select the Alphanumeric PROGRAM screen.

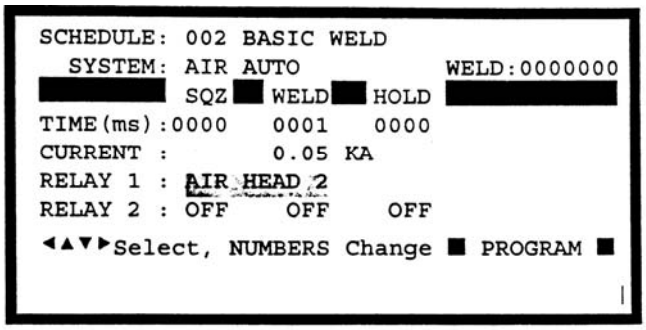


20 Press the down vertical cursor key [▼] until the RELAY 1: NOT USED and RELAY 2: OFF option items appear.



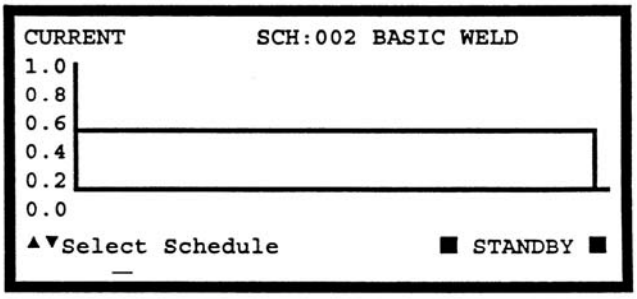
21 Select RELAY 1: NOT USED. Press [CHNG] to select the AIR HEAD 2 option.

22 Press [SAVE] to update Schedule 2, then press [CHNG] to automatically return to the Weld Graph RUN State. You are now ready to adjust the Right Weld Head Air Regulators.

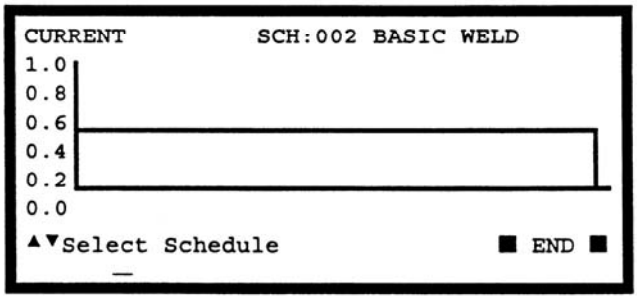


23 Turn both Air Regulators located on the right-hand side of the Right Weld Head Clockwise (CW) to produce 10 psi on the Pressure Gauge.

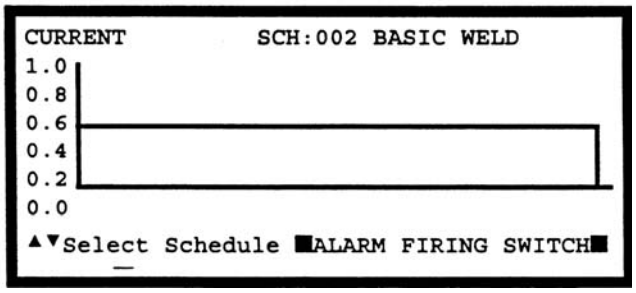
24 Press and hold the Foot Switch completely down to close all switch levels. The lower right hand corner of the display should show the status message STANDBY .



25 Turn the Air Regulator that feeds the Top Right Air Cylinder on the Right Weld Head Clockwise (CW) until the HF2 automatic-ally returns the Upper Electrode to its up position. The lower right hand corner of the display should now show the status message END if you have not released the Foot Switch. Release the Foot Switch.



26 **NOTE:** You have 10 seconds to make the Air Regulator adjustment or a buzzer alarm will sound and the HF2 will automatically return the Upper Electrode to its up position. The status message changes from STANDBY to ALARM FIRING SWITCH . Press [RUN] to clear the alarm, then repeat steps 24 and 25.



27 Re-adjust the Air Regulator that feeds the Bottom Right Air Cylinder on the Right Weld Head to produce the same air pressure as finally used on the Top Air Regulator on the Right Weld Head.

28 Adjust the Right Weld Head Down Speed Control Knob so the Right Weld Head Upper Electrode descends smoothly onto the parts.

29 Adjust the Right Weld Head Up Speed Control Knob so that the Right Weld Head Upper Electrode Holder does not impact upon returning to in up position.

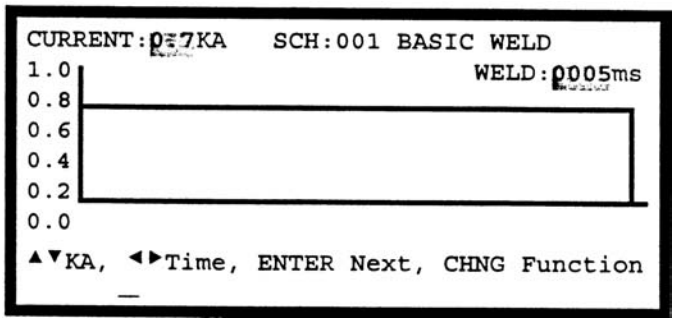
30 Press [▼] to select SCH:001 BASIC WELD. You are now ready to adjust the Left Weld Head Air Regulators.

31 Repeat steps 24 through 29 for the Dual Air Weld Head System, All Regulator Adjustments for the Left Weld Head.

Quick Start Programming Guide

1 Make a test weld using Schedule 1 by pressing on the Weld Head foot actuator until the HF2 Weld Control fires. The default WELD time of 1 ms and the default CURRENT of 0.5 KA may not be sufficient to make a good weld.

2 Press [PROG]. Press [ENTER] to change SQUEEZE to WELD, as displayed in the upper right corner. Use the vertical cursor keys [▲▼] to increase the weld CURRENT. Use the horizontal cursor keys [◄►] to increase or decrease the WELD time. In this example, weld CURRENT has been increased to 0.7 KA and WELD time has been increased to 0.5 ms.



3 Make additional test welds and then re-program WELD time and weld CURRENT as necessary to make a good weld. Try to use the minimum time and current necessary to make a good weld so that the weld joint heat affected zone will be minimized.

4 Press [SAVE] to save the updated Schedule 1. You are now back in the Weld Graph RUN State.

5 Press [>] to select SCH:002 BASIC WELD. You are now ready to make test welds using the Right Weld Head.

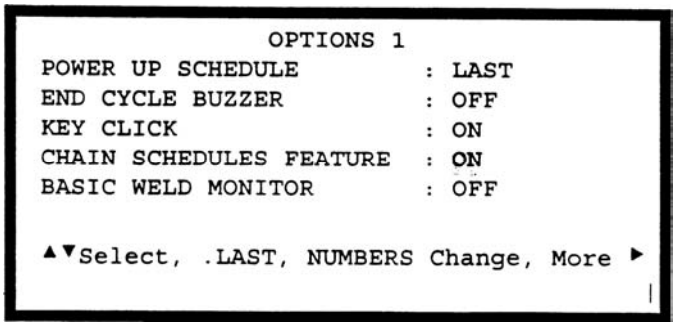
6 Repeat steps 1 through 3 using the Right Weld Head.

7 Press [SAVE] to save the updated Schedule 2. You are now back in the Weld Graph RUN State and ready to turn on the Chaining Feature, which will enable Schedule 1 to automatically sequence to Schedule 2, then back to Schedule 1.

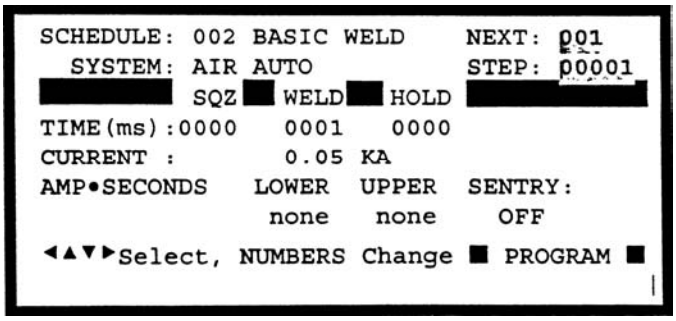
8 Press [MENU] and then select OPTIONS. Use the horizontal cursor key [◄] to select the OPTIONS 1 screen.

9 Select CHAIN SCHEDULES FEATURE: *OFF*. Press [CHNG] to change to *ON*.

10 Press [RUN] to return to the Weld Graph RUN State.



11 Press [PROGRAM] twice to select the Alphanumeric PROGRAM screen for Schedule 2.



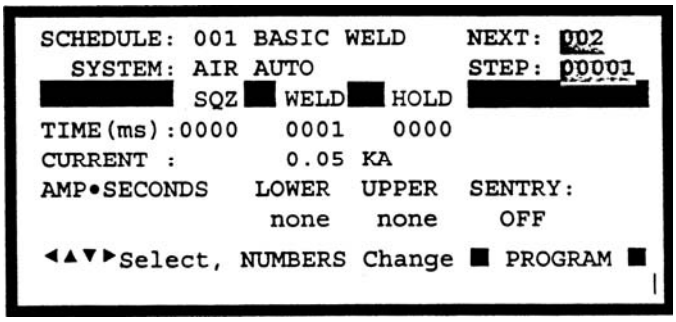
12 Verify that NEXT: 001 is correctly displayed so that Schedule 2 will automatically advance to Schedule 1 after one weld has been completed. If you want to make more than one weld using Schedule 2 before advancing to Schedule 1, change STEP : 00001 to the desired number of welds.

13 Press [SAVE] to save the updated Schedule 2.

14 Press [▼] to select SCH:001 BASIC WELD.

15 Press [PROGRAM] once to select the Alphanumeric PROGRAM screen for Schedule 1.

16 Select NEXT: 001. Change 001 to 002 so that Schedule 1 will automatically advance to Schedule 2 after one weld has been completed. If you want to make more than one weld using Schedule 1 before advancing to Schedule 2, change STEP : 00001 to the desired number of welds.



17 Press [SAVE] to save the updated Schedule 1. Press [CHNG] to return to the Weld Graph RUN State. You are now ready to make alternating welds, beginning with Schedule 1, by just pressing on the Foot Switch to activate each weld.

NON-FORCE FIRED, AIR OR CAM ACTUATED WELD HEAD SYSTEM

PLC to HF2 Weld Control Electrical Connections (Figure 3-6)

1 Connect your Programmable Logic Control (PLC) or Host Computer output control signals to the HF2 Weld Control inputs using reed relays or the open collector of an opto coupler. The emitter of each opto coupler must be connected to The HF2 Weld Control Rear Panel Control Signals connector, Pin 11.

2 For a complete description of how to program Relay 1 and Relay 2, reference *Chapter 5, Programming Modes, Output Relays*.

3 For a complete description on how to use the RS-485 Datacom feature, reference *Chapter 9, RS-485 Datacom*.

4 All weld schedules must be entered and saved using the HF2 Weld Control Front Panel keys. After saving the desired weld schedules, each schedule can be recalled prior to initiating the welding process cycle by closing the binary Remote Schedule Select lines according to the following table:

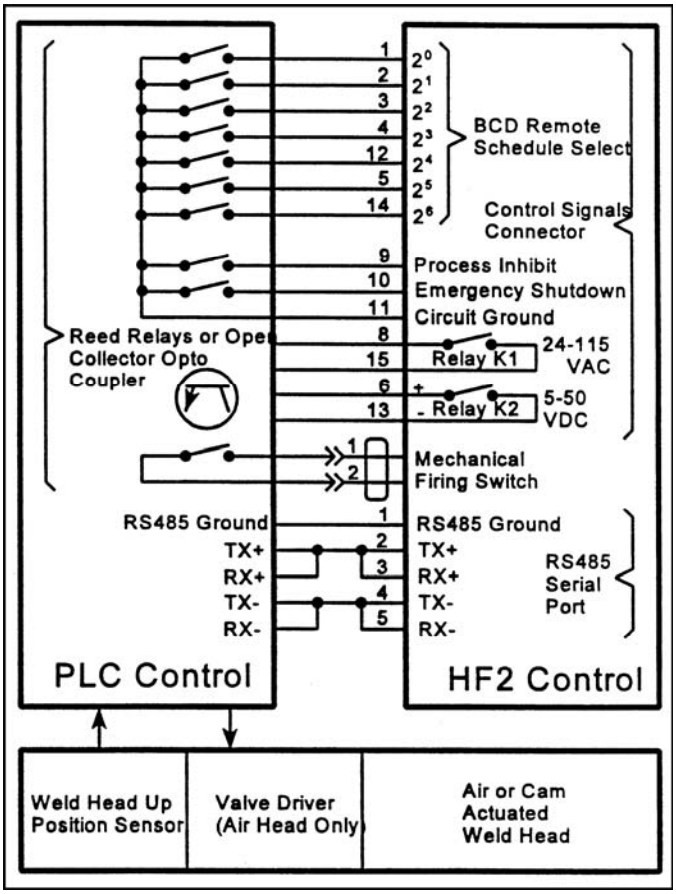


Figure 3-6. PLC to HF2 Weld Control Electrical Connections

WELD SCHEDULE	20 Pin 1	21 Pin 2	22 Pin 3	23 Pin 4	24 Pin 12	25 Pin 5	26 Pin 14
0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0
2	0	1	0	0	0	0	0
3	1	1	0	0	0	0	0
4	0	0	1	0	0	0	0
Binary progression from 5 to 126							
127	1	1	1	1	1	1	1

NOTE: 0 = Open; 1 = Closed

PLC Timing Diagram (Figure 3-7)

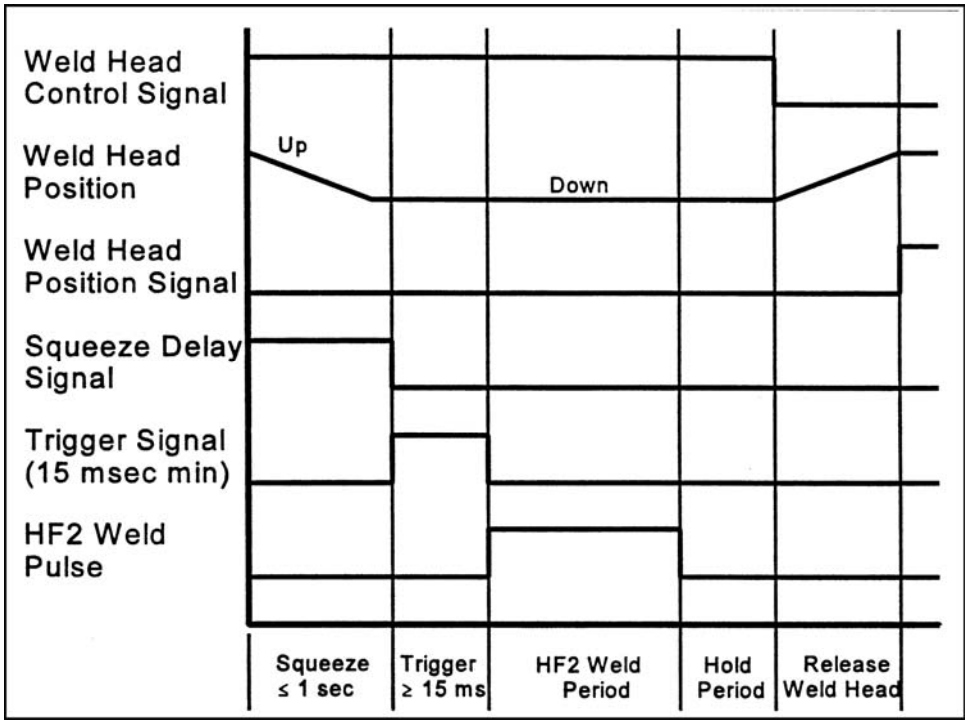


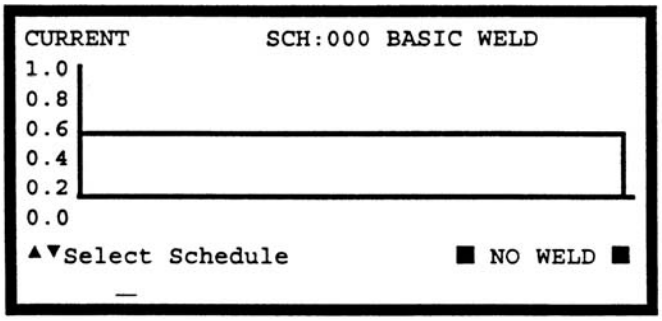
Figure 3-7. PLC Timing Diagram.

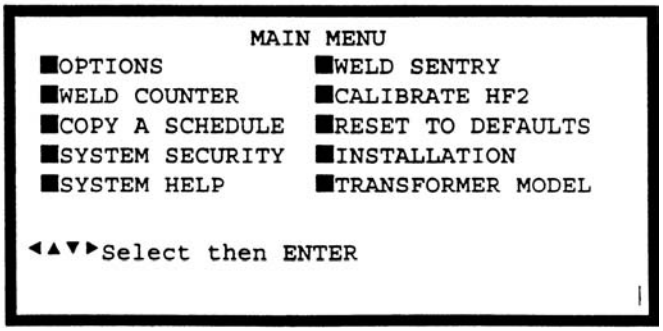
Quick Start Programming Guide

1 Set the HF2 Weld Control front panel WELD/NO WELD switch to NO WELD.

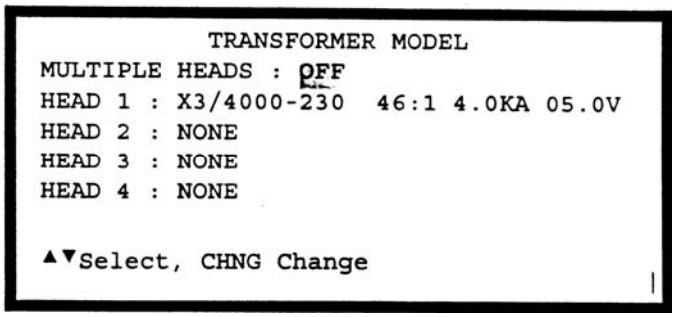
2 Turn the Power Switch located on the HF2 Weld Control rear panel to ON. After a series of power up screens, the last RUN screen displayed will appear. Press the [CHNG] key to access the Weld Graph RUN screen for the BASIC WELD Function.

3 Press [MENU]. The MAIN MENU screen will appear.





4 Select TRANSFORMER MODEL. The TRANSFORMER MODEL screen appears.

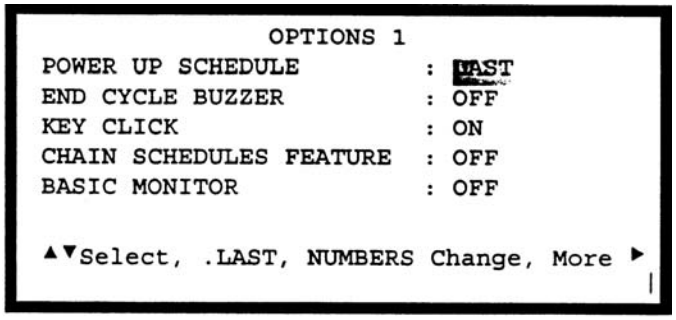


5 Select MULTIPLE HEADS: OFF. If the display reads ON, press [CHNG] until OFF is displayed.

6 Select HEAD 1 : X3/4000-230. X3/4000-230 is the default Transformer Model number. Press [CHNG] until the correct Transformer Model that you have purchased appears.

7 Press [MENU] to return to the MAIN MENU screen.

8 Select OPTIONS. The OPTIONS 1 or OPTIONS 2 screen appears. This example shows the OPTION 1 screen.

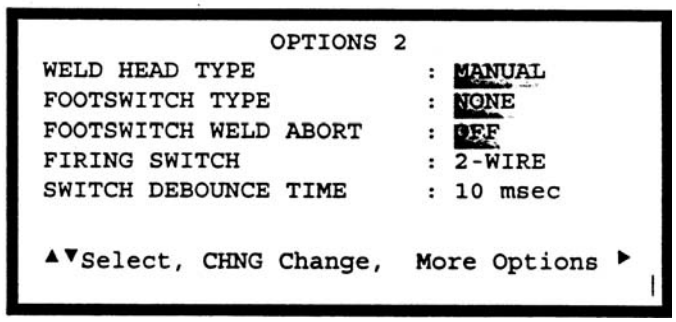


9 Press [◀▶] to select the OPTIONS 2 screen.

10 Select WELD HEAD TYPE: *AUTO*. Press [CHNG] until the *MANUAL* option appears. **Note:** FOOTSWITCH TYPE: *AUTO* will automatically change to *NONE*.

11 Select FOOTSWITCH WELD ABORT: ON. Press [CHNG] until the OFF option appears.

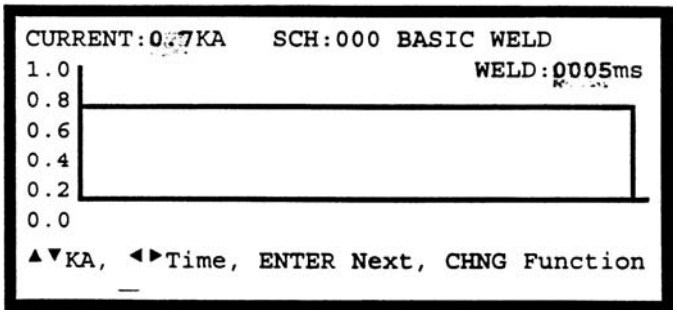
12 12.Press [RUN] to return to the Weld Graph RUN State.



13 Set the HF2 Weld Control front panel WELD/NO WELD switch to WELD.

14 Make a test weld by pressing on the Weld Head foot actuator until the HF2 Weld Control fires. The default WELD time of 1 ms and the default CURRENT of 0.5 KA may not be sufficient to make a good weld.

15 Press [PROG]. Use the vertical cursor keys [▲▼] to increase the weld CURRENT. Use the horizontal cursor keys [◀▶] to increase or decrease the WELD time. In this example, weld CURRENT has been increased to 0.7 KA and WELD time has been increased to 0.5 ms.



16 Press [SAVE] to save your program. You are now back in the Weld Graph RUN State.

17 Make additional test welds and then re-program WELD time and weld CURRENT as necessary to make a good weld. Try to use the minimum time and current necessary to make a good weld so that the weld joint heat affected zone will be minimized.

18 Up to 128 different weld schedules can be created and saved. To manually recall any specific weld schedule, press the up or down vertical arrow keys [▲▼] until the desired schedule number appears on the display screen. A faster technique for recalling a specific schedule is to input the Schedule number using the number keys.

19 To recall any weld schedule automatically, use the binary Remote Schedule Select Control Lines as discussed under the step 4 of the *PLC to HF2 Weld Control Electrical Connections* section.

NON-FORCE FIRED, MULTIPLE AIR ACTUATED WELD HEAD SYSTEM

This system configuration is not released.

CHAPTER 4
CONTROLS

HF2 Weld Control - Front Panel (Figure 4-1)

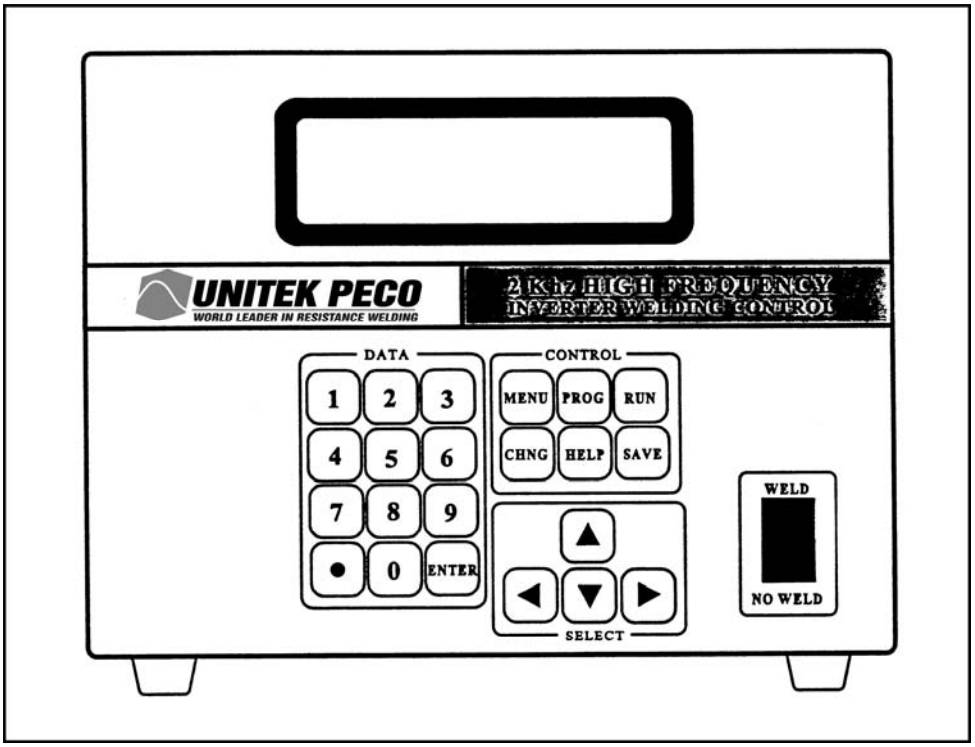


Figure 4-1. HF2 Weld Control Front Panel

KEY	DESCRIPTION
[KEYPAD]	Use the numeric keys to enter numeric information. Use the [.] to enter decimal values.
[KEYPAD]	Use the numeric keys to change weld schedules without the need to use the [▲▼] keys. For example, pressing [1] [0] will recall weld schedule 10.
[▲▼]	In the RUN State, press [▲] to select a higher number weld schedule or press [▼] to select a lower number weld schedule.
[▲▼]	In PROGRAM and MENU States, use both [▲▼] to move up and down on the LCD Display to select user options.
[◄►]	In the PROGRAM and MENU States, use [◄►] to select user options.

[PROG]	In the RUN State, press [PROG] to enter the Graphical PROGRAM State to make changes to the selected weld schedule fields. Press [PROG] a second time to make changes using the Alphanumeric PROGRAM State. Press [PROG] a third time to make changes to the Weld Sentry programs related to the selected weld schedule. Press [PROG] a fourth time to return to the HF2 Graphical Program screen.
[RUN]	In the PROGRAM State, press [RUN] to exit the PROGRAM State without saving the changed weld schedule. The changed weld schedule will become Weld Schedule 0 and will not be written to permanent memory. Welding parts is done in the RUN State.
[RUN]	In the MENU State, press [RUN] to exit the MENU State and begin welding parts.
[SAVE]	In the PROGRAM State, press [SAVE] to save the selected weld schedule and its related Weld Sentry programs to permanent memory. The HF2 Weld Control will then automatically exit the PROGRAM State and return to the RUN State. [SAVE] has no function in the RUN State.
[MENU]	In either the RUN or PROGRAM States, press [MENU] to provide a menu list of user options which are common to all weld schedules.
[HELP]	Press this key whenever you need HELP or additional information on any user menu option or flashing user programmable field. The HF2 contains a built-in operating manual. Press [HELP] a second time to return to the original State.
[CHNG]	In the PROGRAM State, press [CHNG] to restore the previous contents of a user programmable field.
[CHNG]	In the MENU State, press [CHNG] to select different menu options.
[CHNG]	In the RUN State, press [CHNG] to change the Graphical RUN State screen to the Alphanumeric RUN State screen.
[ENTER]	Press [ENTER] after keying in numeric program data.
WELD/NO WELD SWITCH	Weld current will not flow when this switch is in the NO WELD position. However, operation in the NO WELD switch position permits the HF2 to initiate and execute a complete welding sequence without weld current flowing. Operating the HF2 in the NO WELD position is required to adjust Unitek Peco Weld Heads. This switch must be in the WELD position in order to make a weld.

HF2 Weld Control - Rear Panel Inputs and Outputs

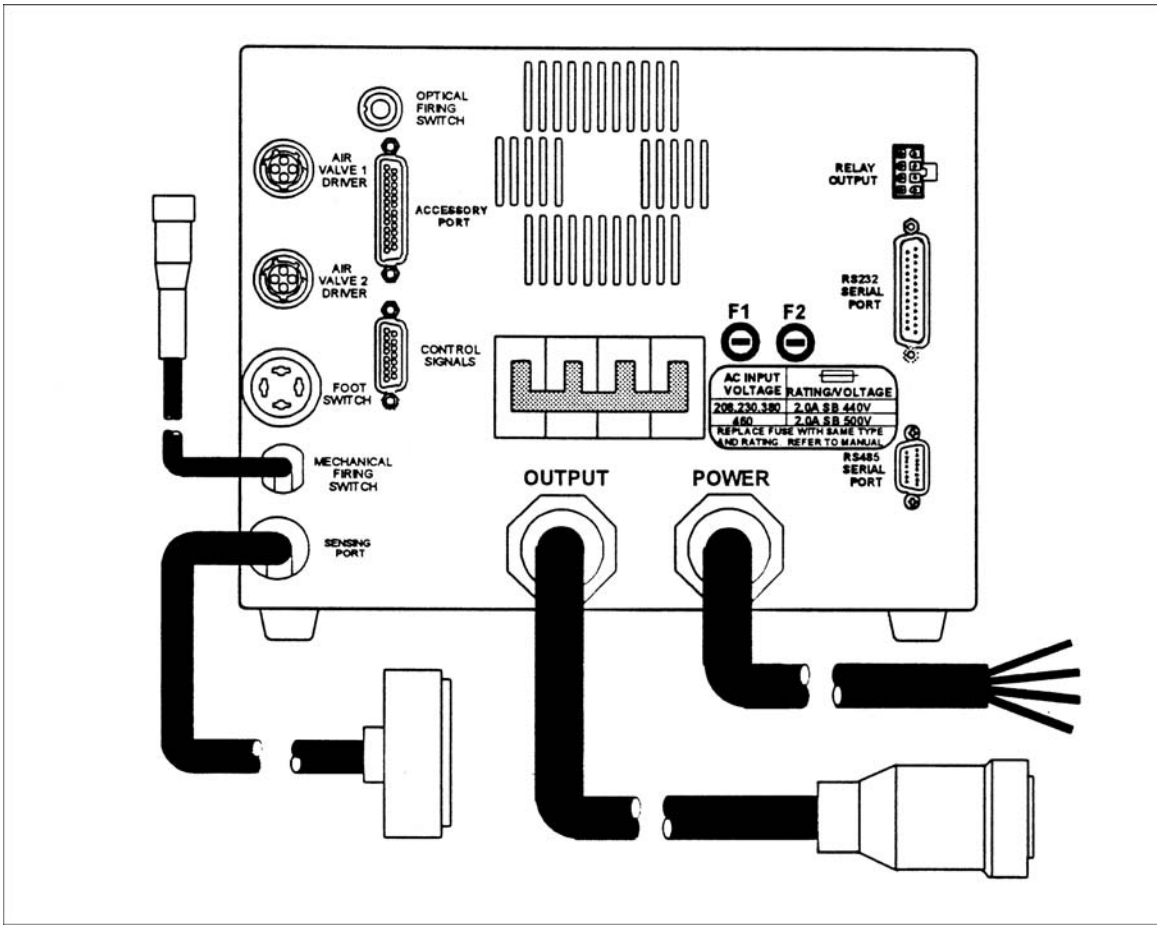


Figure 4-2. HF2 Weld Control Rear Panel

- POWER - Refer to *Chapter 2, Power Line Voltage, Current, and Wire Size Requirements,* for complete instructions on how to properly apply power to the HF2 Weld Control.
- FUSES F1, F2 - Refer to *Chapter 2, Power Line Fuse Requirements* for complete specifications for Power Line Fuse sizes.
- SENSING PORT

  The Sensing Port contains both input and output lines for communicating to the HF2 Weld Transformer and the MA-600 Multiple Weld Head Selection Box. The connector attached to the end of the Sensing Port Cable is a 16 pin Honda, P/N: MC16LSF, (Unitek P/N: 250-235). This connector mates with the connector on the HF2 Weld Transformer.

Sensing Port - Connector Pin Assignments

Pin No.	Wire Color	Description
1	Red	Secondary Weld Current Measurement
2	Red	+12 VDC
3	Red	Secondary Weld Voltage Measurement
4	Red	Weld Transformer Select Line 2 (For MA-600)
5	Red	Weld Transformer Thermo Switch
6	Red	Weld Transformer Select Line 4 (For MA-600)
7	Red	Digital Signal Ground
8	Black	230 VAC Weld Transformer Fan
9	Black	Secondary Weld Current Measurement Return
10	Black	Weld Transformer Select Line 1 (For MA-600)
11	Black	Secondary Weld Voltage Measurement Return
12	Black	Weld Transformer Select Line 3 (For MA-600)
13	Black	Weld Transformer Thermo Switch Return
14	Black	Future Expansion
15	Red	Future Expansion
16	Red	230 VAC Weld Transformer Fan Return

OUTPUT

The Output Cable feeds high voltage, pulse width modulated, primary weld current to the primary winding of the HF2 Weld Transformer. The connector attached to the end of the Output Cable is an AMP 206136-1 (Unitek P/N: 520-115). The mating connector on the HF2 Weld Transformer is an AMP 206137-1 (Unitek P/N: 550-071).

Pin No.	Wire Color	Description
1	Black	Primary HF2 Weld Transformer
2	Red	Primary HF2 Weld Transformer
4	Green	Chassis Ground
6	White	Primary HF2 Weld Transformer Return
7	Orange	Primary HF2 Weld Transformer Return

FOOT SWITCH Connector

HF2 Weld Control FOOT SWITCH connector uses a 4-pin Amphenol 91-PC4F (Unitek P/N: 550-1-006) bulkhead connector that mates with an Amphenol 91-MC4M (Unitek P/N: 520-1-009).

Single-Level Foot Switch (Figure 4-3)

1 A Single-Level Foot Switch must be fully depressed by the operator. When the Foot Switch closes, the HF2 Weld Control energizes the Air Actuated Weld Head, causing the Upper Electrode to descend and apply force to the parts. If the Foot Switch is released before the Weld Head applies the Preset Firing Force, the HF2 Weld Control will automatically return the Upper Electrode to its up position.

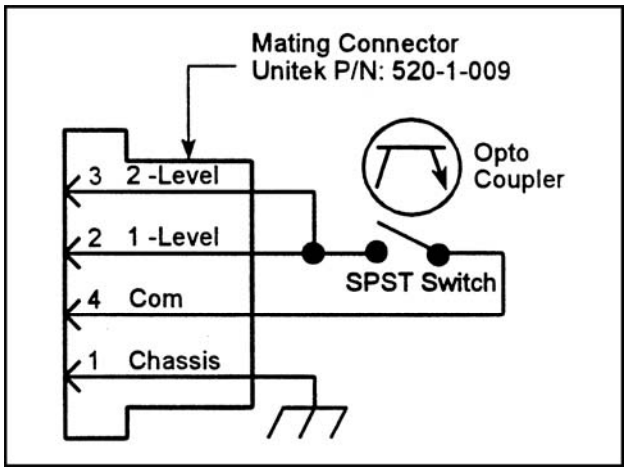


Figure 4-3. Single-Level Foot Switch

2 Connect a Unitek Model FS1L Foot Switch, reed relay, or the open collector of an opto coupler to the Foot Switch connector to initiate the welding process. The emitter of the opto coupler must be connected to Pin 4.

3 When using a non-Unitek Peco Foot Switch, connect Pin 2 to Pin 3.

Two-Level Foot Switch (Figure 4-4)

1 When a Two -Level Foot Switch is pressed to the first level, the HF2 Weld Control energizes the Air Actuated Weld Head, causing the Upper Electrode to descend and apply force to the parts. If the Foot Switch is released before the operator presses the Foot Switch to the second level, the HF2 Weld Control will automatically return the Upper Electrode to its up position so that the parts can be re-positioned. Once the second level has been reached and the Force Firing Switch in the Weld Head has closed, Weld Current will flow and the HF2 Weld Control will automatically return the Upper Electrode to its up position.

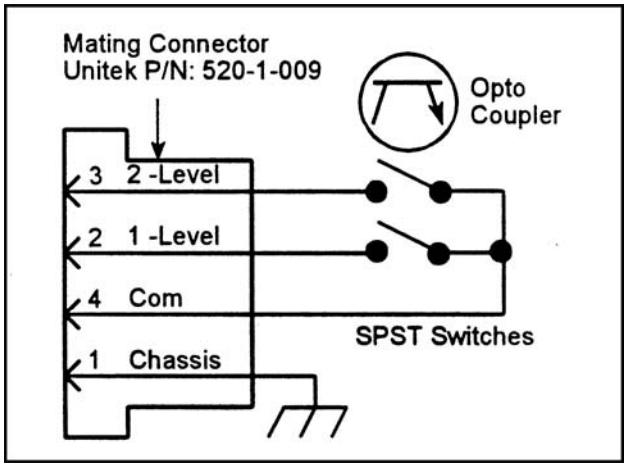


Figure 4-4. Two-Level Foot Switch

2 Connect a Unitek Model FS2L Foot Switch, reed relay, or the open collector of an opto coupler to the Foot Switch connector to initiate the welding process. The emitter of the opto coupler must be connected to Pin 4.

Firing Switch Operation

The HF2 Weld Control can use: (a) a Single Pole, Single Throw Switch (SPST); (b) a Single Pole, Double Throw (SPDT 3-wire) Switch; or (c) an Optical Switch as an input signal to indicate when the Weld Head has applied the proper force to the parts. Weld Heads with single pole Firing Switches should be connected to the Mechanical Firing Switch Connector. A 3-Wire Switch or Optical Firing Switch, either of which should be connected to the Optical Firing Switch Connector, eliminate switch bounce, which causes false triggering, and should be used when the welding speed exceeds 1.5 welds per second.

MECHANICAL FIRING SWITCH Cable

1 The Mechanical Firing Switch Cable is 5 feet long, Type 2/C, 600 volt cable and contains 2 shielded, twisted 22 AWG conductors of high-flex stranded wire. The Firing Switch Connector is a 2-pin Amphenol 80-MC2FI (Unitek P/N: 520-011), with strain relief that mates with an Amphenol 80-MC2M (Unitek P/N: 520-001). Pin 2 is Digital Ground.

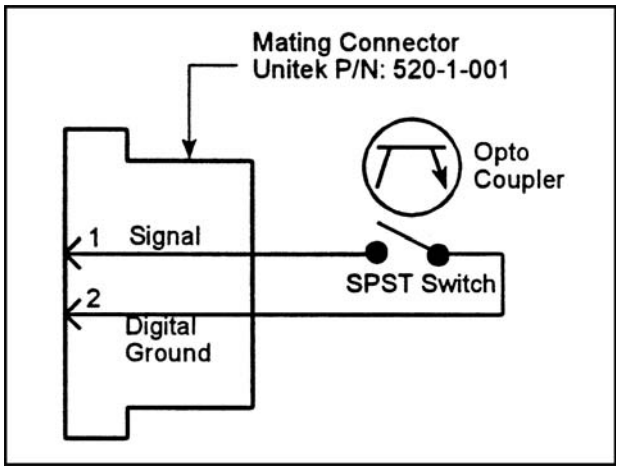


Figure 4-5. Mechanical Firing Switch

2 Connect a Unitek Model Weld Head Firing Switch, reed relay, or the open collector of an opto coupler to the Foot Switch connector to initiate weld current. The emitter of the opto coupler must be connected to Digital Ground, Pin 2.

OPTICAL FIRING SWITCH Connector

The Optical Firing Switch Connector is a 5 pin AMP 212044-1 (Unitek P/N: 550-064) bulkhead connector and mates with an AMP Assembly consisting of an AMP 212437-3 Plug, 212435-7 Ferrule and 212800-1 Strain Relief. The Optical Firing Switch can be used in two configurations for initiating a welding process: a) Single Pole Double Throw (SPDT 3-wire); or b) Opto Coupler.

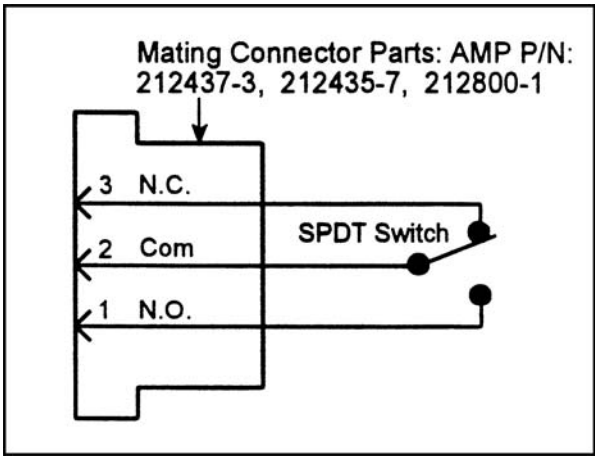


Figure 4-6. Wire Firing Switch

Mechanical Firing Switch - 3-Wire Connection

A SPDT (3-wire) mechanical switch can be connected to the Optical Firing Switch connector to eliminate the use of Switch Debounce Time when welding at rates of 1.5 welds/second.

Opto Coupler Firing Switch - 3-Wire Connection

A SPDT opto coupler switch can be connected to the Optical Firing Switch connector to eliminate the use of Switch Debounce Time when welding at rates of greater than 1.5 welds/second.

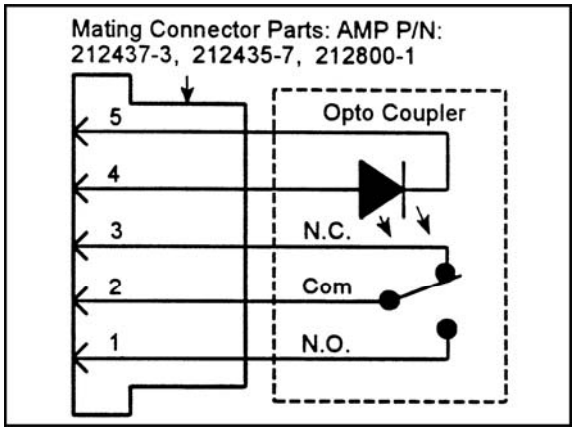


Figure 4-7. Opto Coupler Firing Switch

CONTROL SIGNALS Connector

1 A 15-pin, sub-miniature "D" Control Signals Connector includes inputs for: (a) Remotely selecting weld schedules 1 through 127; (b) Inhibiting the HF2 Weld Control from beginning a new welding process; and (c) Invoking an Emergency Stop Condition which abruptly terminates the welding process. The Control Signals inputs and outputs are designed to be used with a Programmable Logic Control (PLC) (see Figure 4-8) or a Host Computer in automated environments.

2 When an external chain control box is connected to the Control Signals Connector in place of a PLC, chained weld schedules can be implemented semi-automatically with an external chain control box (see Figure 4-9).

3 The Control Signals Connector also includes outputs for: a) One DC Solid State Relay; and b) One AC Solid State Relay.

4 The 15 pin connector is a Viking DMRST15RA05CG (Unitek P/N: 250-1-195). The mating connector is a TRW Cinch Connector comprised of a DA-15P (Unitek P/N: 250-1-199) male connector and a DE-51210-1 (Unitek P/N: 250-1-200) plastic junction shell. The mating connector is included in the HF2 Weld Control Shipping Kit.

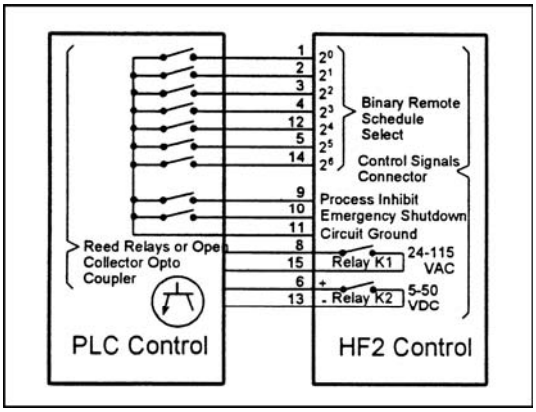


Figure 4-8. Control Signals Connection

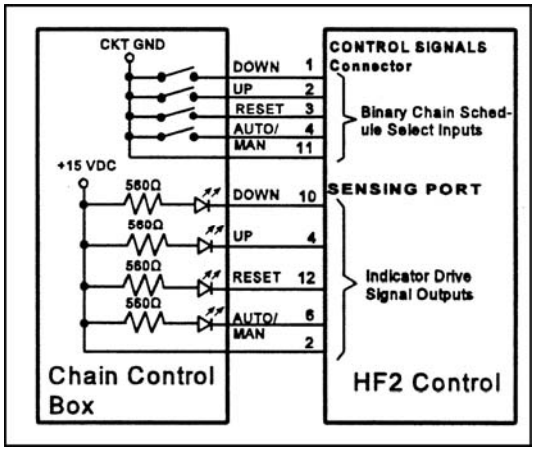


Figure 4-9. Remote Chain Control Box Input/Output Signals

5 Connect a reed relay, or the open collector of an opto coupler to the Control Signals connector to initiate the selection process. The emitter of the opto coupler must be connected to Pin 11. Keep the selected input closed to maintain the selection.

Control Signals - Pin Assignments

Pin No.	I/O	Description
1	Input	PLC input: Remote Weld Schedule Selection, Control Line 20 Chain control box (CCB) input: Schedule Down (decrement number)
2	Input	PLC input: Remote Weld Schedule Selection, Control Line 21 CCB input: Schedule Up (increment number)
3	Input	PLC input: Remote Weld Schedule Selection, Control Line 22 CCB input: Reset (set schedule # to power up schedule #)
4	Input	PLC input: Remote Weld Schedule Selection, Control Line 23 CCB input: Auto/Manual (enable/disable chain function)
5	Input	Remote Weld Schedule Selection, Control Line 25
6	Out-put	Relay K2, + 5-50 VDC (User must supply power)
7	NC	
8	Out-put	Relay K1, 24-115 VAC (User must supply power)
9	Input	Process Inhibit
10	Input	Emergency Stop
11	Input	Circuit Ground
12	Input	Remote Weld Schedule Selection, Control Line 24
13	Out-put	Relay K2, + 5-50 VDC Return
14	Input	Remote Weld Schedule Selection, Control Line 26
15	Out-put	Relay K1, 24-115 VAC Return

Control Signals - Remote Weld Schedule Selection Input

All weld schedules must be entered and saved using the HF2 Weld Control Front Panel keys. After saving the desired weld schedules, each schedule can be recalled prior to initiating the welding process cycle. Using the PLC (Figure 4-8), remote weld schedule selection (chain schedule feature turned off) can be implemented by closing the binary Remote Schedule Select lines according to the following table:

WELD SCHED	2^0 Pin 1	2^1 Pin 2	2^2 Pin 3	2^3 Pin 4	2^4 Pin 12	2^5 Pin 5	2^6 Pin 14
0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0
2	0	1	0	0	0	0	0
Binary progression from 3 to 126							
127	1	1	1	1	1	1	1

NOTE: 0 = Open; 1 = Closed

Using a remote chain control box in place of the PLC, a semi-automatic chain weld schedule can be used to control the remote schedule select lines through the Control Signals Connector in accordance with the following table:

Pin No.	Function	Description
1	Schedule Down	Decrement the schedule number
2	Schedule Up	Increment the schedule number
3	Reset	Set the schedule number = power up schedule number
4	Auto/Manual	Enable (Auto)/disable (Manual) the chain schedule function

Note: If (Manual) is selected on pin 4, the chain control box will override the HF2 chain schedule on/off function and weld schedules can be selected manually from the chain control box (see Figure 4-9).

Control Signals - Emergency Stop Input (Figure 4-8)

Connect a reed relay, or the open collector of an opto coupler to Pin 10 of the Control Signals connector to immediately terminate the welding process. No welding process can be initiated until the switch closure has been removed. The emitter of the opto coupler must be connected to Pin 11.

Control Signals - Process Inhibit Input (Figure 4-8)

Connect a reed relay, or the open collector of an opto coupler to Pin 9 of the Control Signals connector to prevent a new welding process from beginning. No welding process can be initiated until the switch closure has been removed. The emitter of the opto coupler must be connected to Pin 11.

Control Signals - Output Relays (Figure 4-8)

There are two output relays which can be used to provide status or timing signals to a user Programmable Logic Control (PLC) or Host Computer. Relay K1 can switch a 24 to 115 VAC signal. Relay K2 can switch a 5 to 50 VDC signal. When used for status signals, these relays can be independently programmed to close (a) when the HF2 Weld Control is initiated; (b) when any portion of the welding process is completed; (c) when the Firing Switch opens; or (d) when the HF2 Weld Control is waiting for the welding process sequence to start.

Relay K1 (Figure 4-10)

1 Connect a 24 to 115 VAC voltage source and PLC load to Pins 8 and 15 on the Control Signals Connector. Maximum relay current is limited to 250 ma.

2 Relay K1 is also used to control the Air Valve 2 Driver for sequentially activating a second Air Actuated Weld Head. Refer to *Chapter 3, Unitek Peco, Force Fired, Dual Air Actuated Weld Head System* for complete instructions to set up and operate two sequential action Air Actuated Weld Heads. When MENU, OPTIONS 2, WELD HEAD TYPE: is set to DUAL AIR, the options for RELAY 1 must be either AIR HEAD 2 or NOT USED. Air Valve 2 Driver will be actuated in any Schedule in which RELAY 1 is defined as AIR HEAD 2. Air Valve 1 Driver is actuated in any Schedule in which RELAY 1 is defined as NOT USED.

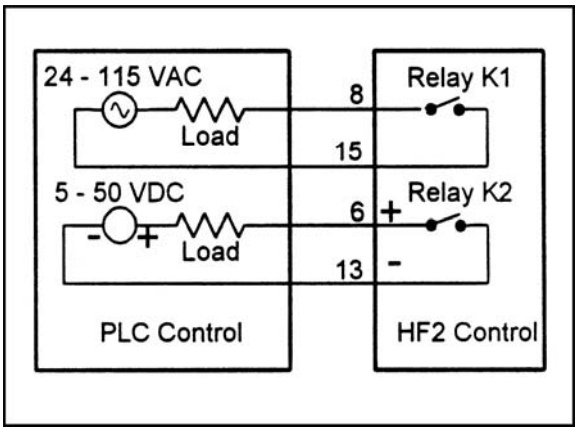


Figure 4-10. Relay K and K2 Connections

Relay K2 (Figure 4-10)

Connect a 5 to 50 VDC voltage source and PLC load to Pins 6 (Positive) and 13 (Negative) on the Control Signals Connector. Maximum relay current is limited to 250 ma.

Accessory Port (Figure 4-2)

A 25-pin, sub-miniature D-type connector, located on the rear panel, is provided to control other devices contemplated for future expansion.

AIR VALVE 1 and AIR VALVE 2 Driver Connectors (Figure 4-11 and Figure 4-12)

Air Valve 1 Driver (Figures 4-11 and 4-12)

Each Air Valve Driver uses a 4-pin black plastic AMP 206430-1 (Unitek P/N: 550-062) bulkhead connector. The mating plug is an AMP 206429-1 (Unitek P/N: 520-107) which uses a cable clamp, Amp 206358-2 (Unitek P/N: 245-084) and 3 male pins AMP 66361-2 (Unitek P/N: 253-055). When using a non-Unitek Peco Air Actuated Weld Head, connect Pin 2 to Pin 4. The HF2 Weld Control can sequentially operate two separate Air Actuated Weld Heads using Air Valve 1 Driver and Air Valve 2 Driver outputs.

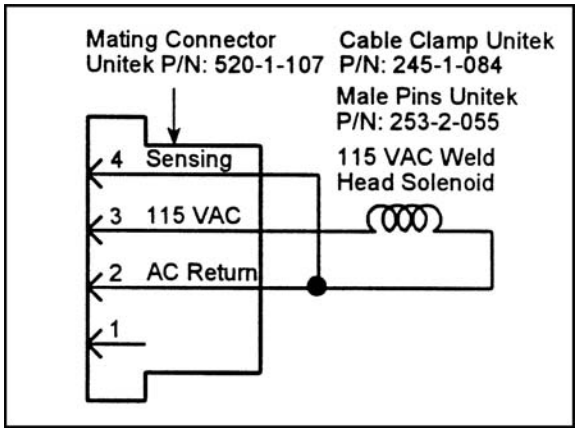


Figure 4-11. 115 VAC Weld Head Solenoid

Air Valve 1 Driver (Figures 4-11 and 4-12)

The output of Air Valve 1 Driver is 12 VA at 115 or 24 volts VAC. The HF2 Weld Control automatically applies the correct solenoid voltage to the Air Actuated Weld Head connected to the Air Valve 1 Driver.

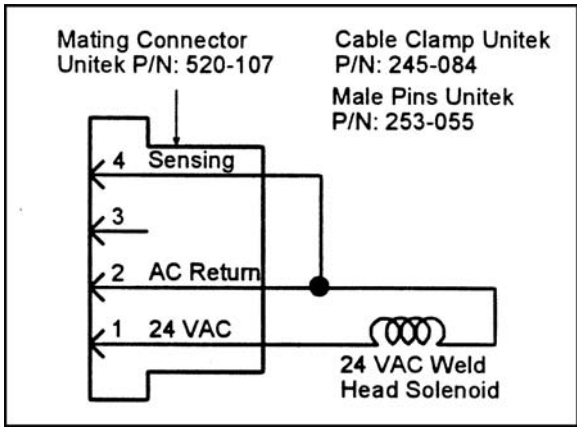


Figure 4-12. 24 VAC Weld Head Solenoid

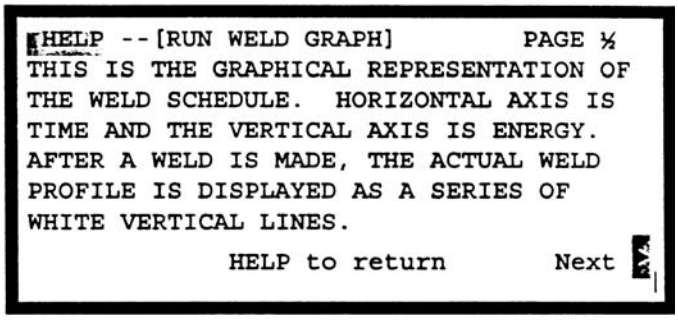
Air Valve 2 Driver (Figure 4-12)

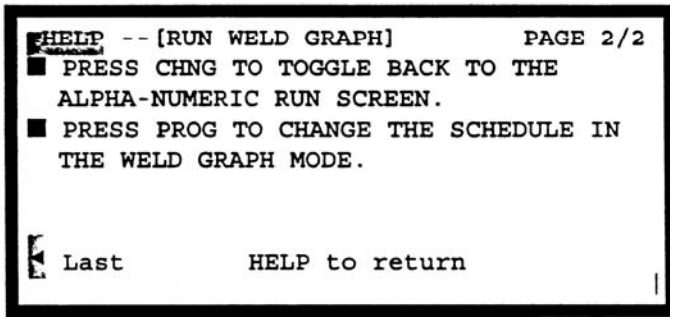
Air Valve 2 Driver provides 24 VAC at 12 VA to power a second Air Actuated Weld Head. To provide 24 VAC to Air Valve 2 Driver, jumpers E10 and E11 on the control board must be moved to the correct positions. Refer to *Chapter 3, Unitek Peco, Force Fired, Dual Air Actuated Weld Head System* for complete instructions to set up and operate two sequential action Air Actuated Weld Heads. Note: When Air Valve 2 Driver is used, Relay K1 cannot be used for marking weld periods or activating alarm conditions.

CHAPTER 5
PROGRAMMING MODES

Help Screens

NOTE: We offer our non-English speaking users help screens written in various languages (refer to *Appendix D*). For further information, please contact the factory.





1 The HF2 Weld Control offers the user context sensitive HELP when running or programming. Press [HELP] whenever you want information about a Menu Option or program variable. Press [HELP] again to return to the original screen. For example, if you press [HELP] from the RUN State, information on the function of the Weld Graph and Alphanumeric screens will appear.

2 To read the second page of help information, press the right horizontal cursor key [►].

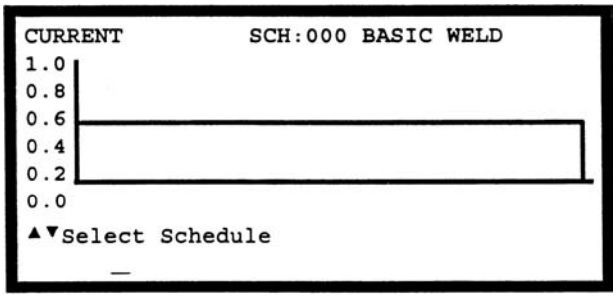
3 To return to the first page of help information, press the left horizontal cursor key [◄].

Machine States

The HF2 Weld Control has eight Machine States: RUN, NO WELD, STANDBY, ALARM, FIRE, MENU, PROGRAM, and HELP. The NO WELD State represents the positional status of the WELD/NO Switch on the front panel. The STANDBY, ALARM, and FIRE states are functions of MECHANICAL FIRING, OPTICAL FIRING, and FOOT SWITCH input states. The operator can force the HF2 Weld Control into the RUN, MENU, PROGRAM, and HELP states by pressing the [RUN], [MENU], [PROG] or [HELP] keys.

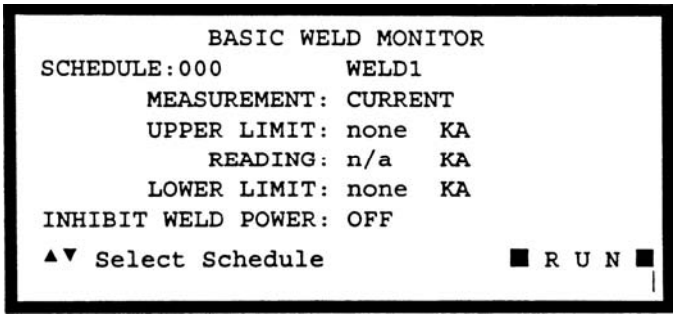
Weld Graph RUN State

In the Weld Graph RUN State, the HF2 Weld Control is ready to make a weld. You can select, but not change, any weld schedule by using the vertical cursor keys [▲] or [▼] on the Front Panel. Weld schedules may also be selected by using the numeric keypad to key in the desired weld schedule number: 000 through 127.



Basic Weld Monitor Run State

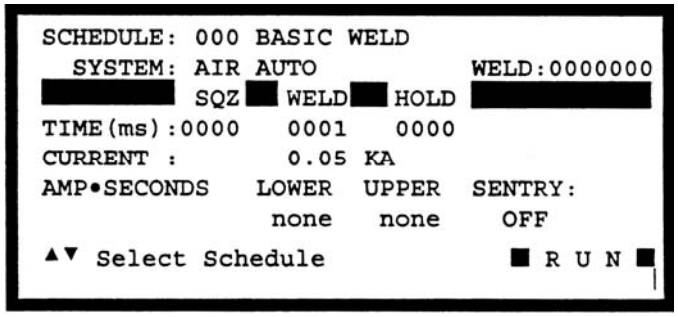
When MENU, OPTIONS 1, WELD MONITOR: is set to BASIC, pressing [CHNG] will cause the display screen to switch from the Weld Graph RUN screen to the Basic Weld Monitor RUN screen. Setting WELD MONITOR to LIMIT causes the Energy Limit Monitor screen to be displayed. See *Chapter 7* and *Chapter 8* for detailed instructions.



Pressing [CHNG] again causes the Basic Weld Monitor RUN screen to switch to the Alphanumeric RUN screen. Pressing [CHNG] once more returns the display screen to the Weld Graph RUN screen.

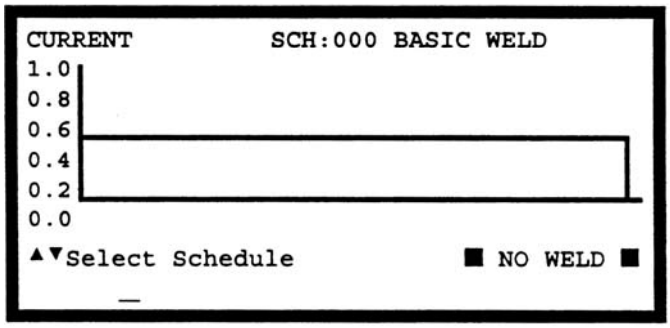
Alphanumeric RUN State

Pressing [CHNG] will cause the display screen to change from the Basic Weld Monitor RUN screen, if this option has been set to ON, to the Alphanumeric RUN screen. Pressing [CHNG] again will return the HF2 Weld Control to the Weld Graph screen. Welding can be performed in any RUN screen.



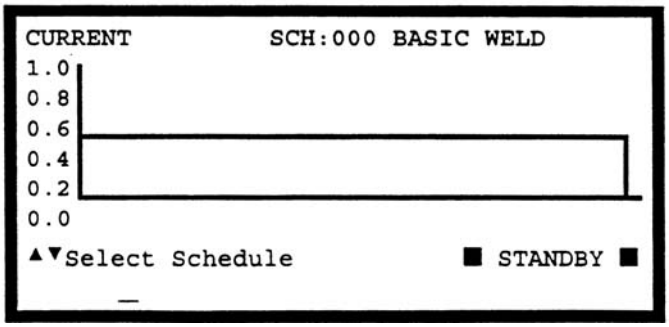
NO WELD State

Switching the WELD/NO WELD front panel switch to the NO WELD position prevents weld current from flowing but does permit the HF2 Weld Control to performing its electronic functions. Use the NO WELD State when adjusting the air regulators on Air Actuated Weld Heads.



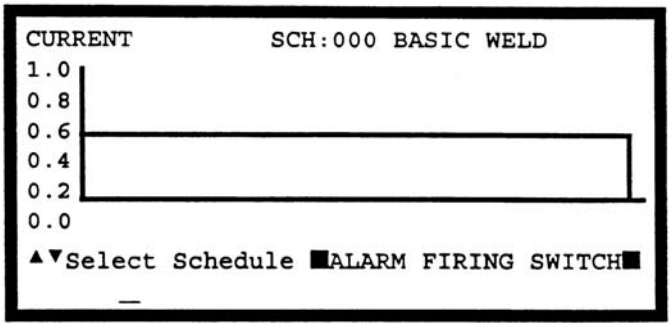
STANDBY State

The HF2 Weld Control is waiting for a mandatory event to occur such as: (a) the Firing Switch in a Unitek Peco Air Actuated Weld Head to close; (b) the second level of a 2-Level Foot Switch to close; or (c) waiting to be reset to another schedule after a STOP Command in a Chained Schedule.



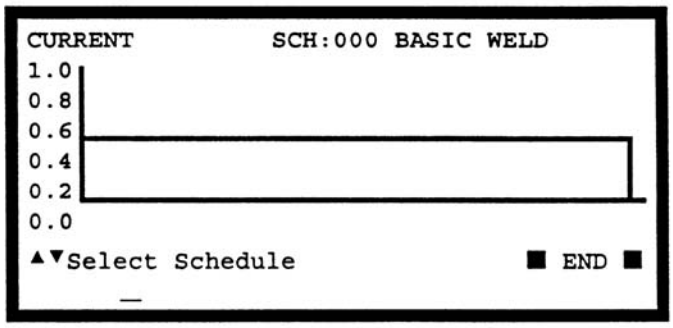
ALARM State

The HF2 Weld Control automatically recognizes many alarm conditions which are described in detail under *Appendix C, Alarm Messages*. The ALARM FIRING SWITCH screen shown on the right is displayed when the Firing Switch of a Unitek Peco Air Actuated Weld Head does not close within 10 seconds.



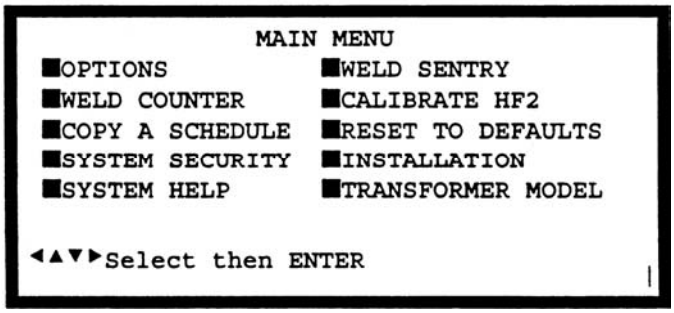
FIRE State

Once weld current is flowing, the HF2 Weld Control is in the Fire State. Weld current can be terminated by: (a) removing the first level of a single-level Foot Switch; (b) removing the second level of a two-level Foot Switch; or (c) shorting the Emergency Stop Control Signals Input Pin 10 to Pin 11. Completion of the Firing State is indicated by momentary appearance of the END status message as shown in the example to the right.



MENU State

Pressing [MENU] puts the HF2 Weld Control in the MENU State, which offers you different options common to all weld schedules such as how the HF2 Weld Control interfaces with the Firing Switch, Foot Switch, and Weld Head. Like a tree with many branches, there are multiple Menu levels. Each new level is accessed by making an option selection, then pressing [ENTER]. To return to a previous Menu level, press [MENU]. For a complete description on Menu Options, refer to *Chapter 7, System Options.*



PROGRAM State

1 In the PROGRAM State, the HF2 Weld Control allows the user to change and save any weld schedule. In those units which include the Weld Sentry Option, the PROGRAM State also allows the user to change the Measurement Unit, the Limits related to each Weld Sentry program, as well as the other parameters associated with the Weld Sentry.

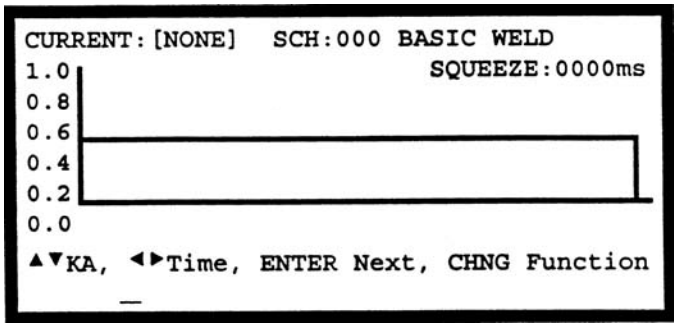
2 A single weld schedule uses one Weld Function. A Weld Function is defined as a series of user programmable time periods, some of which have programmable weld current, voltage, or power levels. Some periods such as SQUEEZE, COOL, QUENCH, HOLD, and OFF do not have any weld current values associated with them. For a complete description of all Weld Functions, their time periods, and limit values, refer to *Chapter 6, Advanced Welding Functions*.

3 SQUEEZE Time is automatically included as a weld schedule program variable when MENU OPTIONS 2, WELD HEAD TYPE: is set to AUTO, AIR, or DUAL AIR and an Air Actuated Weld Head is connected to the HF2 Weld Control. Squeeze Time allows sufficient time for a non-force fired Weld Head to apply the required weld force to the work pieces. Squeeze Time is not normally used with Unitek Peco force fired Weld Heads. The weld period will start as soon as the Squeeze Time expires. Squeeze Time can be set to any number between 0 and 2000 ms.

NOTE: There are two methods of programming the HF2 Weld Control: (a) use the Weld Graph PROGRAM State; or (b) use the Alphanumeric PROGRAM State.

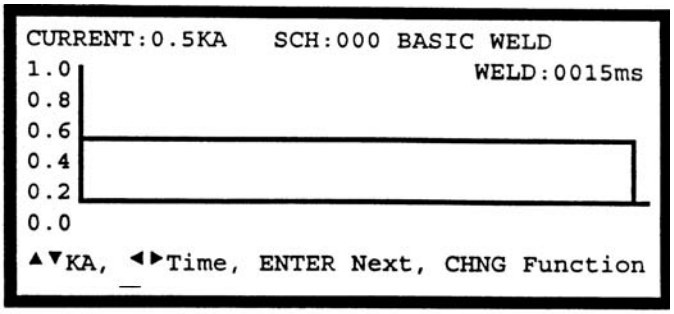
Weld Graph PROGRAM State

1 Use the vertical cursor keys [▲▼] to select the weld schedule that you want to modify. Press [PROG] to enter the Weld Graph PROGRAM State.

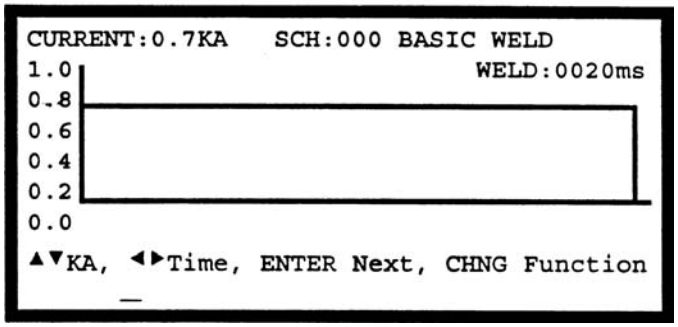


2 Press [ENTER] to select the period that you want to modify. Note: the upper right-hand corner shows the selected period. Use the horizontal cursor keys [◄►] to increase or decrease the period time base which is also displayed in the upper right-hand corner following the selected period. You can also change the period time base by using the keypad to directly enter the exact time. Periods such as SQUEEZE, COOL, QUENCH, HOLD, and OFF do not have any weld current, voltage, or energy values. This example shows an Air Actuated Weld Head schedule with the SQUEEZE period set to 0000 ms.

3 Periods such as WELD, WELD1, WELD2, and TEMPER have user programmable time base values and weld current, voltage, or energy values. To change the Feedback Type for any of these weld periods, press the keypad decimal point [.] multiple times until the upper left-hand portion of the screen shows the desired Feedback Type. This example shows a WELD period of 15 ms with the weld CURRENT set to 0.5 kA.



4 To change the weld current, use the vertical cursor keys [▲▼] to increase or decrease the weld CURRENT. Note: when holding the vertical cursor keys down to change the weld CURRENT, the horizontal bar representing the weld CURRENT will not move to its new position until the vertical cursor keys [◄►] are released. However, the weld CURRENT value displayed in the upper left-hand corner will automatically scroll during this change process. In this example, weld CURRENT has been increased to 0.7 kA and WELD time has been increased to 20 ms.

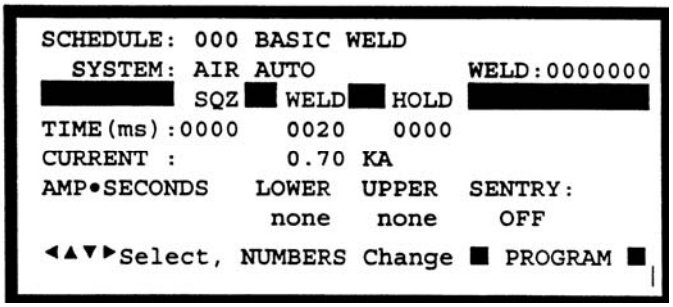


5 Press [SAVE] to save the updated weld schedule. You are now back in the Weld Graph RUN State.

Alphanumeric PROGRAM State

1 Use the vertical cursor keys [▲▼] to select the weld schedule that you want to modify. From the Weld Graph RUN State or Basic Weld Monitor RUN State, press [PROG] multiple times to enter the Alphanumeric PROGRAM State. If you are already in the Alphanumeric PROGRAM State, press [PROG] once.

2 Use the vertical cursor keys [▲▼] and horizontal cursor keys [◄►] to select the program value that you want to change. Use [CHNG] to select CURRENT, VOLTAGE or POWER Feedback. Use the numeric keypad to enter variable values. This example shows the alpha-numeric version of weld schedule 000 in the middle of this page. Weld CURRENT is set to 0.7 kA and WELD time to 20 ms.



3 Press [SAVE] to save the updated weld schedule.

4 Press [CHNG] To operate the HF2 Weld Control in the Weld Graph State.

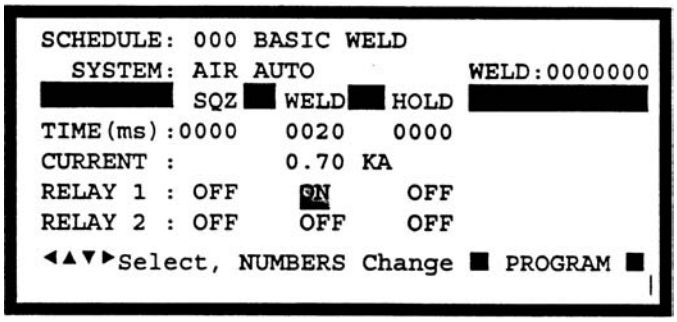
Output Relays

The HF2 Weld Control has two solid state relays which can be used to provide status or timing signals to a user Programmable Logic Control (PLC). For a full description on how to connect Relay K1 and Relay K2, refer to *Chapter 4, Control Signals, Output Relays.*

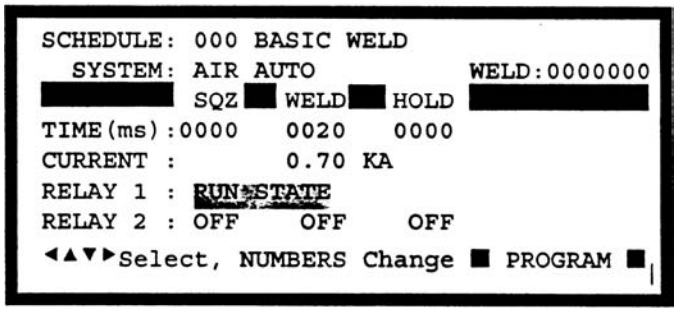
1 Relay K1 and Relay K2 can only be programmed in the Alphanumeric PROGRAM State.

2 Use the vertical cursor keys [▲▼] to select the weld schedule that you want to modify. From the Weld Graph RUN State or Basic Weld Monitor RUN State, press [PROG] multiple times to enter the Alphanumeric PROGRAM State. If you are already in the Alphanumeric PROGRAM State, press [PROG] once.

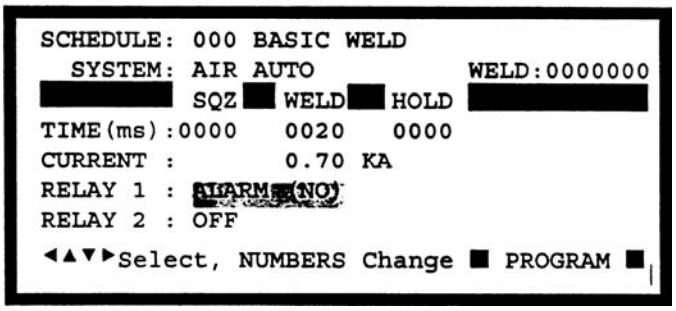
3 Press [▼] until the RELAY 1 and RELAY 2 legends are displayed. Both relays can be activated in the SQUEEZE, WELD, and HOLD periods. Press [CHNG] to select ON. In this example, RELAY 1 will turn on during the WELD period.



4 There are four more RELAY 1 options listed under the SQZ period column. Press [CHNG] to select the RUN STATE option. In this example, notice that the RELAY 1 options for the WELD and HOLD periods disappear. Selecting the RUN STATE option will cause RELAY 1 to always be on when the HF2 is not making a weld.



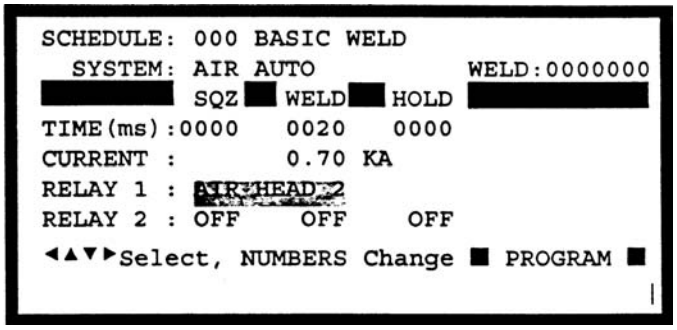
5 Press [CHNG] until the ALARM (NO) option appears. An ALARM condition causes RELAY 1 to switch from the normally open (NO) state to the closed state. RELAY 1 automatically opens when the alarm condition is cleared by pressing [RUN] or when the next welding sequence begins.



6 Press [CHNG] until the ALARM (NC) option appears. An alarm condition causes RELAY 1 to switch. An alarm condition causes RELAY 1 to switch from the normally closed state (NC) to the normally open state. RELAY 1 automatically closes when the alarm condition is cleared by pressing [RUN] or when the next welding sequence begins.

7 Press (CHNG] until the END PROCESS option appears. RELAY 1 automatically turns ON for a period of 20 msec after the last TIME period.

RELAY 1 - Dual Air Head Operation



1 RELAY 1 has one additional option not shared with RELAY 2. RELAY 1 is also used to control the Air Valve 2 Driver for sequentially activating a second Air Actuated Weld Head. Refer to *Chapter 3, Unitek Peco, Force Fired, Dual Air Actuated Weld Head System* for complete instructions to set up and operate two sequential action Air Actuated Weld Heads.

2 When MENU OPTIONS 2, WELD HEAD TYPE: is set to 'DUAL AIR", the options for RELAY 1 must be either AIR HEAD 2 or NOT USED. Air Valve 2 Driver will be actuated in any Schedule in which RELAY 1 is defined as AIR HEAD 2. Air Valve 1 Driver is actuated in any Schedule in which RELAY 1 is defined as NOT USED. This example shows RELAY 1 set to turn on AIR HEAD 2.

3 Press [SAVE] to save the updated weld schedule.

4 Press [CHNG] to operate the HF2 Weld Control in the Weld Graph State.

CHAPTER 6
ADVANCED WELD FUNCTIONS

Weld Functions

A weld function is a unique heat profile created by weld current, voltage, or power that is applied over a fixed time period, to resistance weld different parts. Welding applications requiring the use of specialized weld functions include: (a) parts plated with cadmium, tin, zinc, or nickel; b) parts with heavy oxide coatings such as aluminum; (c) parts that are round or not flat; or (d) parts made of refractory metals such as molybdenum or tungsten.

The HF2 Weld Control is shipped with ten pre-programmed weld functions that are saved in Weld Schedules 001 through 010. While these factory pre-programmed weld functions do not contain sufficient weld time or weld energy for most welding applications, they are a useful starting point to begin welding. Please note that WELD/REPEAT will only work with Air Actuated Weld Heads. The table below lists each Weld Function and its general application.

Weld Function	Pre-Prog Schedule	Typical Application
BASIC WELD	001	Make single spot welds on simple flat parts without plating.
WELD/REPEAT	002	Make multiple semi-automatic spot welds using an operator.
QUENCH/TEMPER	003	Spot weld flat or round parts that have minimum plating thickness.
PRE/POSTHEAT	004	Forge weld heavily oxidized or refractory parts such as molybdenum or tungsten.
UP/DOWNSLOPE	005	Weld round parts, parts that are not flat, spring steel parts, or heavily plated or oxidized parts such as aluminum.
BRAZE	006	Reflow two parts together using a braze material.
ROLLSPOT	007	Make automated multiple weld spots using automatic feeders and PLC or host computer.
SEAM	008	Make automated hermetic seam welds using automatic feeders, and PLC or host computer control. Make manual or semi-automatic non-hermetic seam welds using an operator.
DUAL PULSE	009	Use for best control of miniature and small parts spot welding with or without plating.
PULSATION	010	Use only for spot welding simple parts where the total weld energy or weld time required to make an acceptable weld using any other Weld Function is marginal. Using the Pulsation Weld Function can damage the crystal structure of the parts.

BASIC WELD (Figure 6-1)

Basic Weld is a term used by the industry to describe the simplest heat profile used in the majority of resistance spot welding applications. Use Basic Weld to make single spot welds on flat parts that do not have any plating or heavy oxides. Basic Weld can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

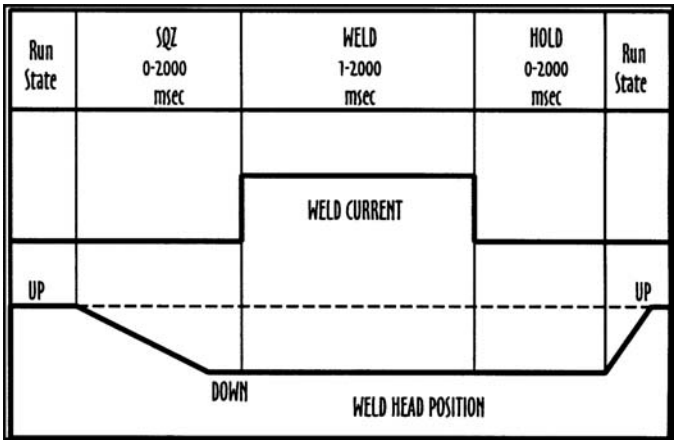


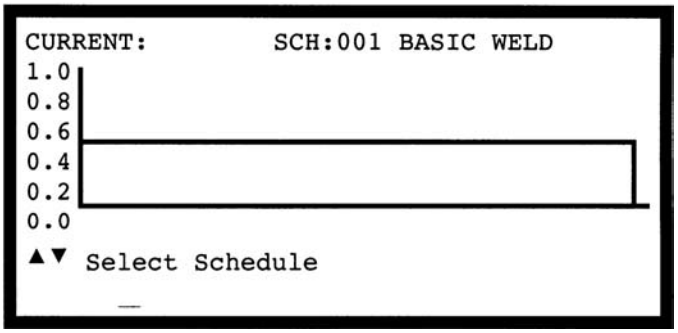
Figure 6-1. Basic Weld

When Basic Weld is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Basic Weld is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens.

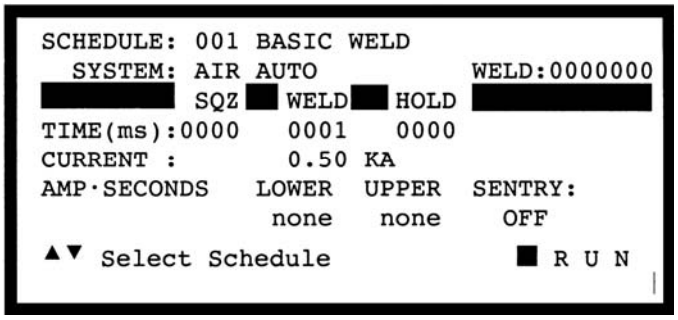
Basic Weld - Weld Graph Run Screen (Figure 6-2)

Weld Schedule 001 is pre-programmed at the factory for Basic Weld operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.



Basic Weld - Alphanumeric Run Screen (Figure 6-3)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.



WELD/REPEAT (Figure 6-4)

Weld/Repeat provides a repeat capability for simple automated Air Actuated Weld Head applications using an operator. This weld function is ideal for volume production, which requires a single schedule.

Weld/Repeat can only be used with an Air Actuated Weld Head. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

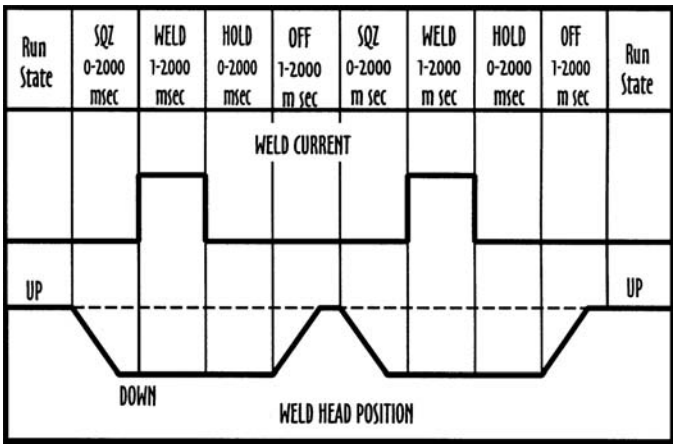


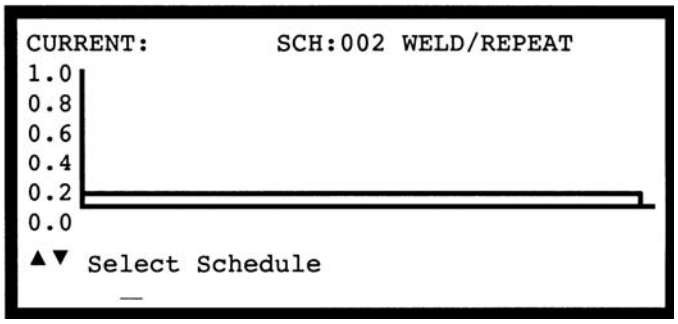
Figure 6-4. Weld/Repeat

When Weld/Repeat is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Weld/Repeat is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens. Off Period, which is applicable only to Weld/Repeat, sets the cycling rate between spot welds by controlling how long the electrodes remain open to allow the parts to be repositioned before the entire weld process repeats.

Weld/Repeat Weld Graph Run Screen (Figure 6-5)

Weld schedule 002 is pre-programmed at the factory for Weld/Repeat operation and will only function using an Air Actuated Weld Head.



Weld/Repeat Alphanumeric Run Screen (Figure 6-6)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

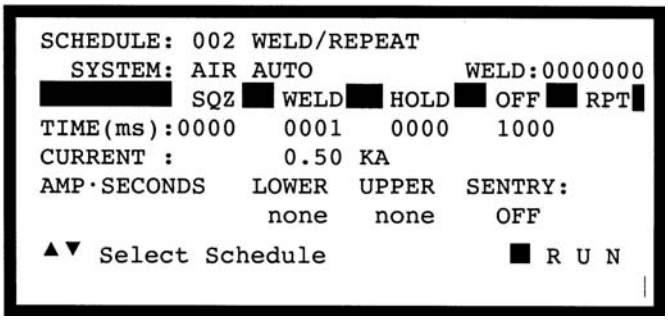


Figure 6-6. Weld/Repeat Alphanumeric Screen.

QUENCH/TEMPER (Figure 6-7)

Quench/Temper is typically used to weld flat-to-flat, round-to-round, or round-to-flat parts together that are plated. Properly used, Quench/Temper can significantly reduce weld splash and electrode sticking.

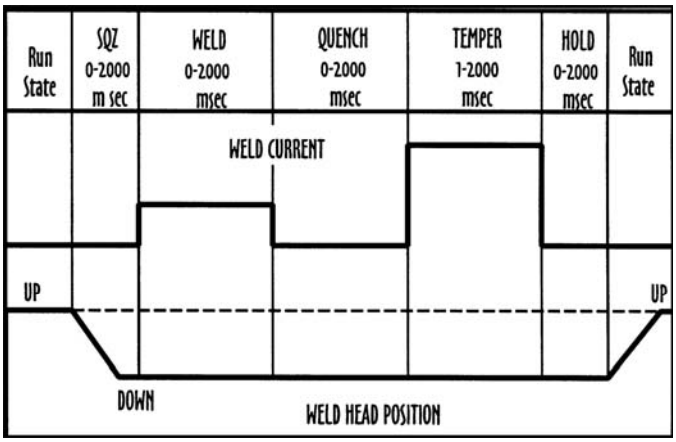


Figure 6-7. Quench/Temper

In the normal application of Quench/Temper, the Weld Period provides sufficient heat to displace the plating or oxides, seat the electrodes against the base metals, and force the parts into intimate contact. The Quench Period allows time to dissipate the heat generated during the Weld Period. The Temper Period completes the structural weld. The Temper Period weld current should be greater than the Weld Period weld current by a factor of two or three since the first bond significantly reduces the resistance of the interface between the parts.

Another use for Quench/Temper is to control grain refinement in the parts. In this application, the Weld Period weld current makes the structural weld. The parts cool during the Quench Period. The low level Temper Period weld current completes the heat treating process by providing sufficient heat to permit grain realignment. In this application, the weld current magnitudes for both the Weld and Temper Periods are completely opposite to those shown in Figure 6-7. 410 stainless steel is one of the materials which must be heat treated (annealed) in order to eliminate the brittle, crystalline structure caused by the weld current. This application of Quench/Temper is not usually used in the form just described for welding small parts.

Quench/Temper can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Quench/Temper is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Quench/Temper is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens.

Quench/Temper - Weld Graph Run Screen (Figure 6-8)

Weld schedule 003 is pre-programmed at the factory for Quench/Temper operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

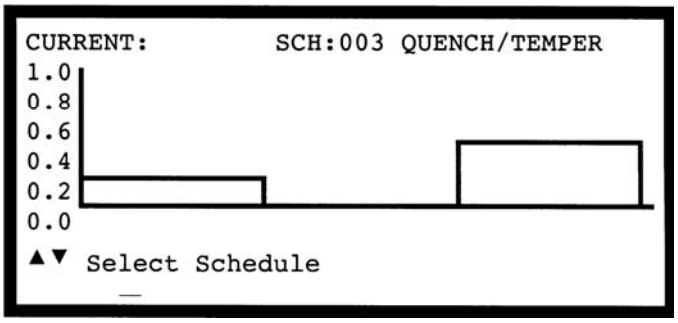


Figure 6-8. Quench/Temper - Weld Graph Run Screen

Quench/Temper - Alphanumeric Run Screen (Figure 6-9)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

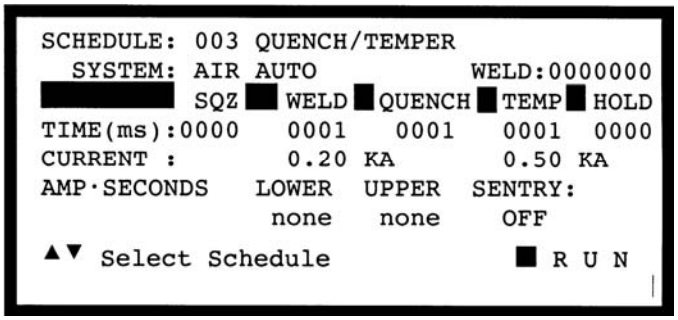


Figure 6-9. Quench/Temper - Alphanumeric Screen

PRE/POSTHEAT (Figure 6-10)

Pre/Postheat is very similar to Quench/Temper. Pre/Postheat is also typically used to weld flat-to-flat, round-to-round, or round-to-flat parts together that may or may not be plated. In addition, Pre/ Postheat works well to create forge type welds when welding refractory materials such as molybdenum and tungsten together.
Pre/ Postheat is the most versatile of all of the weld functions. The user can construct a custom weld function by controlling the three Periods, Preheat, Weld, and Postheat and their related weld currents.

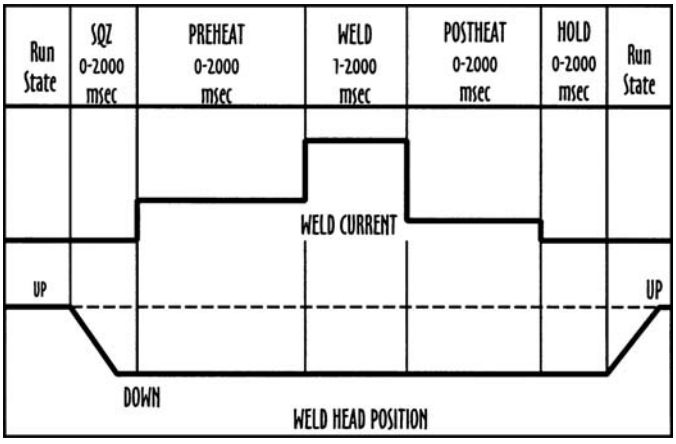


Figure 6-10. Pre/Post Heat

Weld Periods not required can be set to zero. Properly used, Pre/Postheat can significantly reduce weld splash and electrode sticking.

In the normal application of Pre/Postheat, the Preheat Period provides sufficient heat to displace the plating or oxides, seat the electrodes against the base metals, and force the parts into intimate contact. The Preheat Period should be two or three times longer than the Weld Period, which completes the structural weld. The Weld Period weld current should be greater than the Preheat Period weld current by a factor of two or three since the first bond significantly reduces the resistance of the interface between the parts. The Postheat Period immediately follows to provide grain refinement in the parts.

Pre/Postheat can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Pre/Postheat is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Pre/Postheat is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens.

Pre/Postheat - Weld Graph Run Screen (Figure 6-11)

Weld schedule 004 is pre-programmed at the factory for Pre/Postheat operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

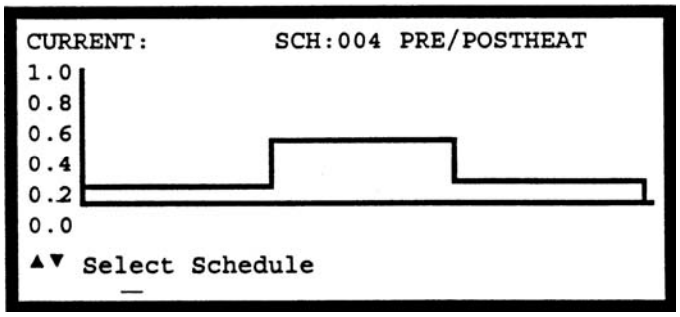


Figure 11. Pre/Postheat Weld Graph Screen

Pre/Postheat - Alphanumeric Run Screen (Figure 6-12)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

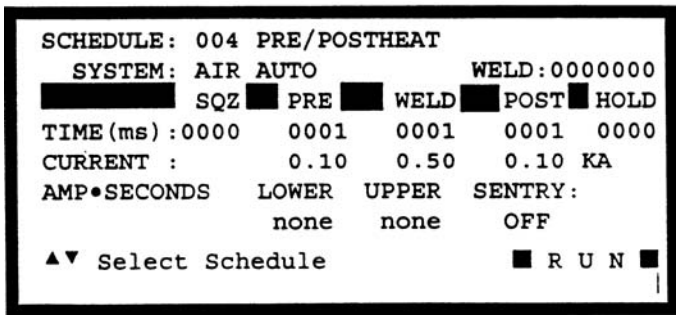


Figure 12. Pre/Postheat Alphanumeric Screen

UP/DOWNSLOPE (Figure 6-13)

Up/Downslope facilitates welding material combinations such as aluminum-to-aluminum or platinum-to-tungsten. Up Slope allows a reduction in electrode force, resulting in a cleaner appearance by reducing electrode indentation, material pickup and electrode deformation. Up Slope can also be used to displace plating and/or oxides, reduce flashing and spitting, or reduce thermal shock when welding parts containing glass-to-metal seals. Downslope assists in the grain refinement of certain heat-treatable steels and prevents cracking in aluminum and other materials by reducing the cooling rate.

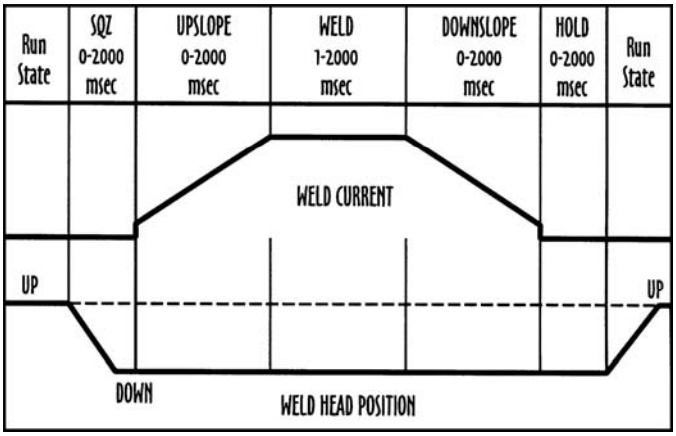


Figure 13. Pre/Postheat Alphanumeric Screen

Up/Downslope can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Up/Downslope is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Up/Downslope is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens.

Up/Downslope - Weld Graph Run Screen (Figure 6-14)

Weld schedule 005 is pre-programmed at the factory for Up/Downslope operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

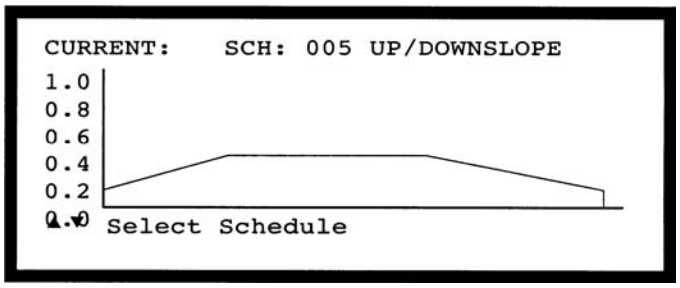


Figure 14. Up/Downslope Weld Graph Screen

Up/Downslope - Alphanumeric Run Screen (Figure 6-15)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

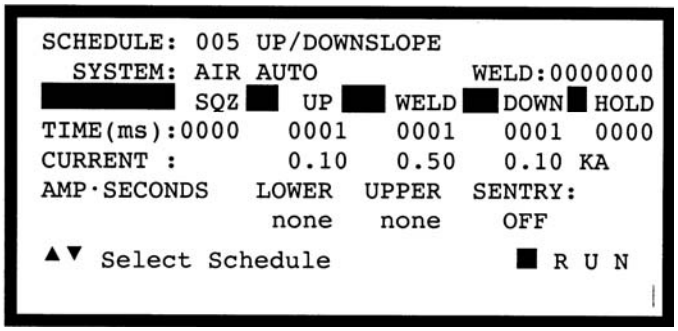


Figure 15. Up/Downslope Alphanumeric Run Screen

BRAZE (Figure 6-16)

This function is ideal for brazing two parts together using a brazing alloy as a "sandwich" between the parts. The brazing alloy can be pre-formed for convenient handling or can be a tin or solder plating on both parts. To ensure complete solidification of the brazing alloy, use the Hold Period to cool the parts.

CAUTION - It is easy to exceed the duty cycle rating for the HF2 Weld Transformer using the Braze weld function. Refer to *Chapter 2, HF2 Weld Transformer Electrical Specifications.*

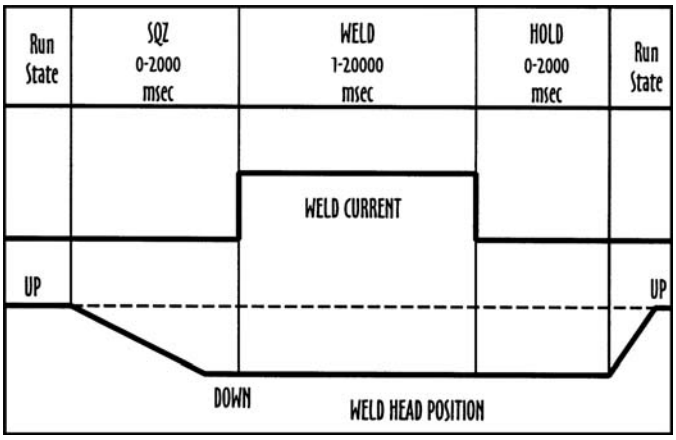


Figure 16. Braze

Braze can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Braze is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Braze is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens.

Braze - Weld Graph Run Screen (Figure 6-17)

Weld schedule 006 is pre-programmed at the factory for Braze operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

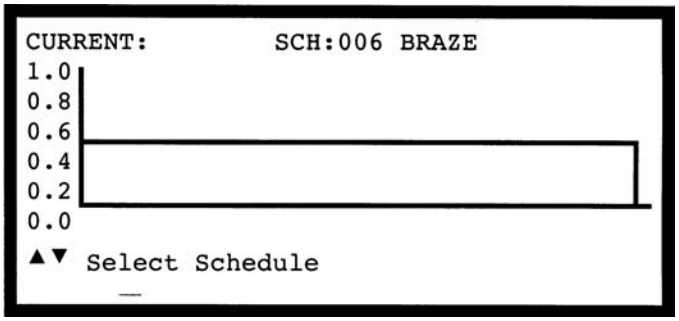


Figure 6-17. Braze - Weld Graph Run Screen

Braze - Alphanumeric Run Screen (Figure 6-18)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

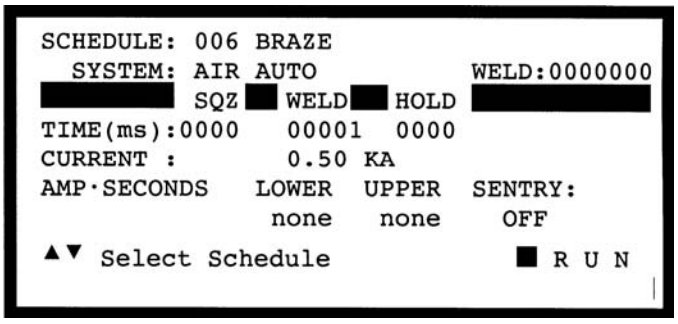


Figure 6-18. Braze - Alphanumeric Run Screen

ROLLSPOT (Figure 6-19)

Rollspot is a special form of seam welding. Typically, upper and lower wheel electrodes, in conjunction with an automatic parts feeder, are used to make a Rollspot weld. Because of the weld current shunting effect after the first weld, set the Weld2 Period weld current greater than Weld1 by a factor of 20% to 50%. Use the larger percentage for closer spacing. Assuming the rotational speed of the wheel is fixed, the Weld2 Period controls the length of the spot and the Cool Period controls the distance between spots.

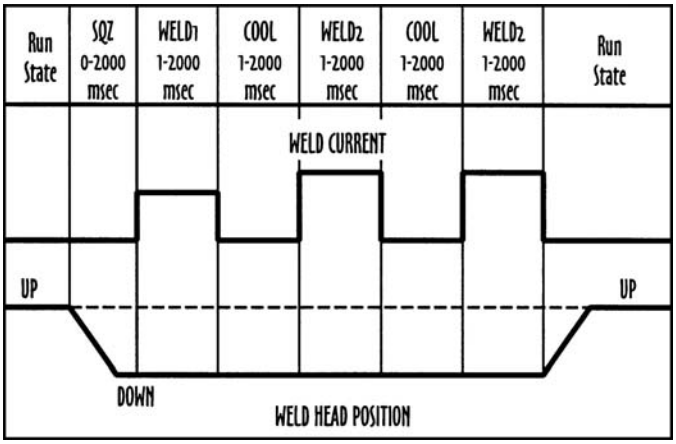


Figure 6-19. Rollspot.

CAUTION: It is easy to exceed the duty cycle rating for the HF2 Weld Transformer using the Rollspot weld function. Refer to *Chapter 2, HF2 Weld Transformer Electrical Specifications*.

Rollspot can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Rollspot is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

Rollspot welding continues for as long as all switches remain closed. Hold has no meaning with Manually Actuated Weld Heads and does not appear on either the weld schedule Program or Run screens.

Rollspot - Weld Graph Run Screen (Figure 6-20)

Weld schedule 007 is pre-programmed at the factory for Rollspot operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

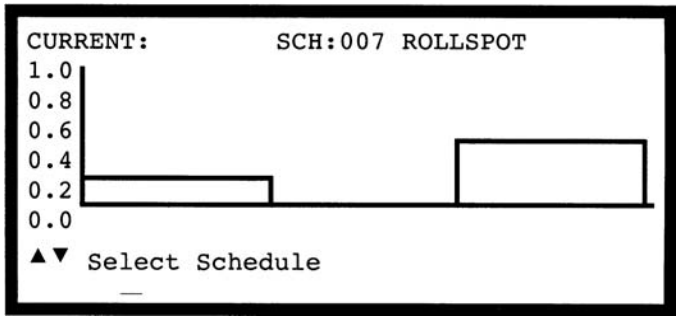


Figure 6-20. Rollspot - Weld Graph Run Screen

Rollspot - Alphanumeric Run Screen (Figure 6-21)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

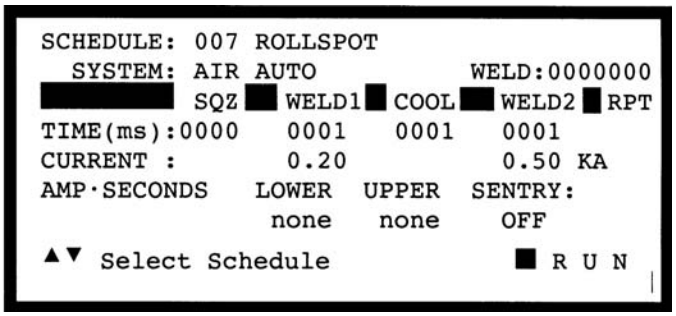


Figure 6-21. Rollspot - Weld Graph Run Screen

SEAM (Figure 6-22)

Seam can be used to make automated hermetic seam welds using automatic feeders, and PLC or host computer control. Seam can also be used to make manual or semi-automatic non-hermetic seam welds using an operator.

CAUTION: It is easy to exceed the duty cycle rating for the HF2 Weld Transformer using the Rollspot weld function. Refer to *Chapter 2, HF2 Weld Transformer Electrical Specifications.*

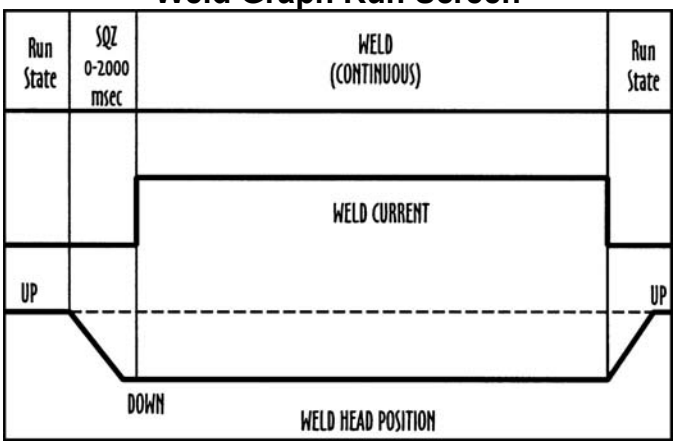


Figure 6-22. Seam

Seam can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Seam is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed. Weld Current flows as long as all switches remain closed.
Hold Period has no meaning with Manually Actuated Weld Heads and does not appear on either the weld schedule Program or Run screens.

Seam - Weld Graph Run Screen (Figure 6-23)

Weld schedule 008 is pre-programmed at the factory for Seam operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

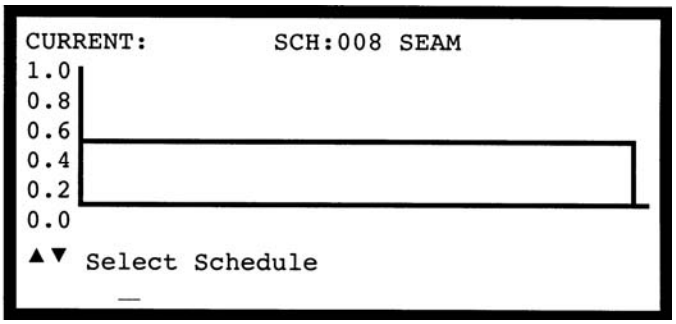


Figure 6-23. Seam Weld Graph Run Screen

Seam - Alphanumeric Run Screen (Figure 6-24)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

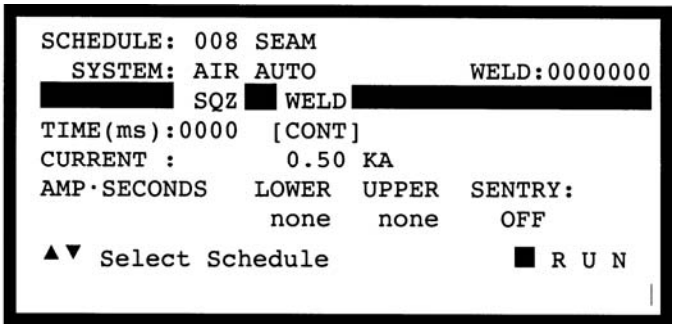


Figure 6-24. Seam Alphanumeric Run Screen

DUAL PULSE (Figure 6-25)

Dual Pulse combines the best features of Up/Downslope with Quench/Temper. Use Dual Pulse for best welding control of flat-to-flat, round-to-round, or round-to-flat small parts that may or may not be plated.

Adding Up Slope to the front of each weld period allows a reduction in electrode force, resulting in a cleaner appearance by reducing electrode indentation, material pickup and electrode deformation. Up Slope will also help to displace plating and/or oxides, reduce flashing and spitting, or reduce thermal shock when welding parts containing glass-to-metal seals.

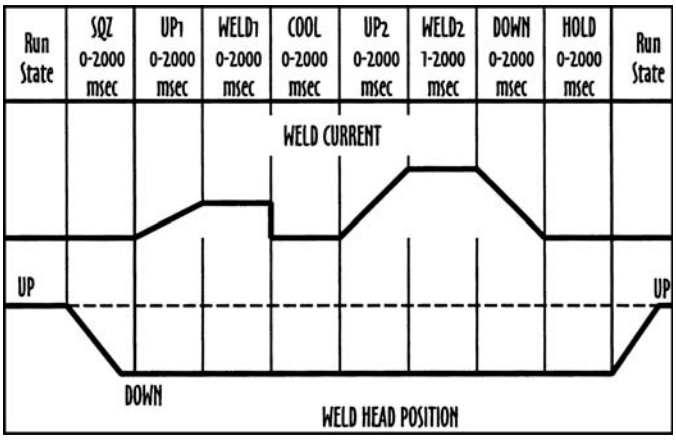


Figure 6-25. Dual Pulse

In the normal application of Dual Pulse, the Weld1 Period provides sufficient heat to displace the plating or oxides, seat the electrodes against the base metals, and force the parts into intimate contact. The Cool Period allows time to dissipate the heat generated during the Weld1 Period.

The Weld2 Period completes the structural weld. The Weld2 Period weld current should be greater than the Weld1 Period weld current by a factor of 2 or 3 since the first bond significantly reduces the resistance of the interface between the parts. The only use for the Down Slope Period following the Weld2 Period is to control grain refinement in brittle parts by slowing reducing the Weld2 Period weld current to zero during the Down Slope Period.

Dual Pulse can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Dual Pulse is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Dual Pulse is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens.

Dual Pulse - Weld Graph Run Screen (Figure 6-26)

Weld schedule 009 is pre-programmed at the factory for Dual Pulse operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

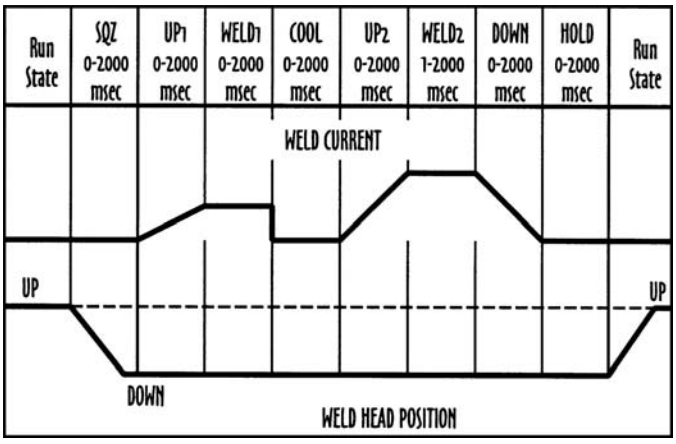


Figure 6-26. Dual Pulse - Weld Graph Run Screen

Dual Pulse - Alphanumeric Run Screen (Figure 6-27)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner. Note: when programming the Dual Pulse weld function that uses an Air Actuated Weld Head, press [▶] to scroll the program screen to the right to access the Down and Hold periods.

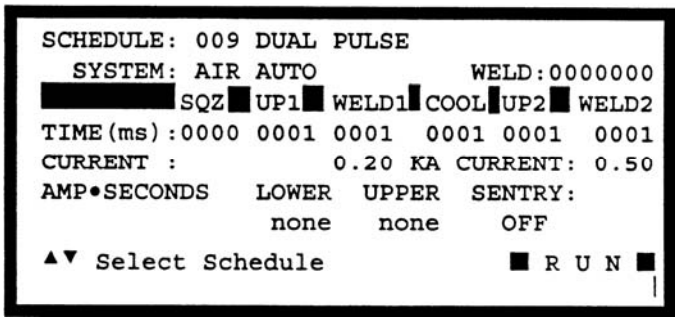


Figure 6-27. Dual Pulse - Alphanumeric Run Screen

PULSATION (Figure 6-28)

Pulsation allows the HF2 Weld Control and largest HF2 Weld Transformer to be used for applications normally requiring more weld energy by pumping in more total weld heat through the use of many sequential weld pulses. The first Weld Period is followed by an alternating sequence of Cool and Weld Periods. The Pulsation number defines how many Cool/Weld Periods will follow the first Weld Period. Using the Pulsation can damage the crystal structure of the parts by making them more brittle.

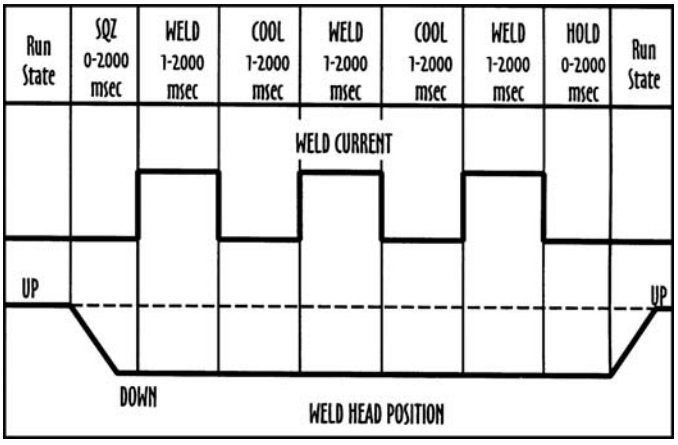


Figure 6-28. Pulsation

Pulsation can be used with Unitek Peco Force Fired Manual or Air Actuated Weld Heads. For Manually Actuated Weld Heads, weld current begins when the Force Firing Switch closes. For Force Fired Air

Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and the Force Firing Switch in the Air Actuated Weld Head closes.

When Pulsation is used with a Non-Force Fired Air Actuated Weld Head, the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts before the Weld Period begins. Weld current begins when the Squeeze Period ends and both levels of a two-level Foot Switch are closed.

When Pulsation is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated for the purpose of providing additional heat sinking or parts cooling. Squeeze and Hold Periods have no meaning with Manually Actuated Weld Heads and do not appear on either the weld schedule Program or Run screens.

Pulsation - Weld Graph Run Screen (Figure 6-29)

Weld schedule 010 is pre-programmed at the factory for Pulsation operation. The HF2 Weld Control automatically recognizes the presence of a Manually or Air Actuated Weld Head before the first weld is made.

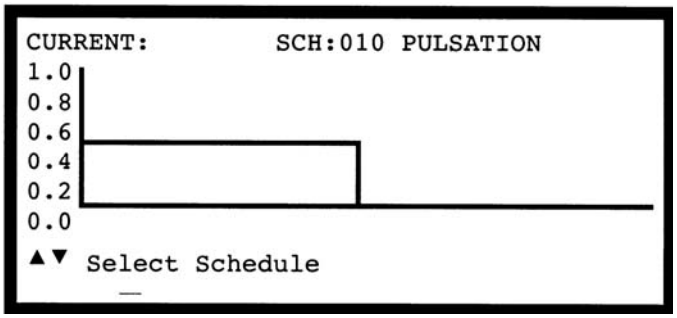


Figure 6-29. Pulsation Weld Graph Run Screen

Pulsation - Alphanumeric Run Screen (Figure 6-30)

To simultaneously view all pre-programmed time periods and energy settings, press [CHNG] to select the Alphanumeric Run screen. The 7 digit Weld Counter is displayed in the upper right corner.

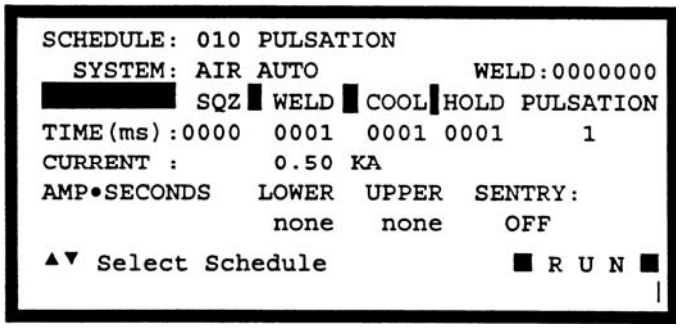


Figure 6-30. Pulsation Alphanumeric Run Screen